Complications of ovariohysterectomy procedures performed in 1880 dogs

L. Muraro¹; R. S. White²

¹Vet 24 Veterinary Clinic, Cavalese (TN), Italy; ²Surgery Department, Dick White Referrals, Suffolk, UK

Key words
Surgery, ovariohysterectomy, complications, side effects, spaying

Summary
Objective: Canine ovariohysterectomy (OVH) is one of the most commonly performed surgical procedures in companion animal practice. The aim of the study was to determine the frequency and types of complications related to OVH. Material and methods: The clinical records of all street dogs admitted to the public dog shelters of the Veneto Region (Italy) between January 2010 and December 2011 were reviewed for dogs that had undergone OVH. Specific comparison was made between anaesthesia time, body weight of the patients and intra- and postoperative complications (occurring up to 4 weeks postoperatively). The data were statistically analyzed. Results: Complications were recorded in 141 of 1880 bitches corresponding to an overall complication rate of 7.5%. Mean ± standard deviation (SD) weight of the bitches was 25.7 ± 6.7 kg and mean ± SD anaesthesia time was 42.8 ± 8.6 minutes. Distinct types of complications included significant ovarian artery haemorrhage, haemorrhage from the surgical wound, wound healing complications, urinary incontinence, ovarian remnant syndrome. Twenty-one patients had intraoperative complications and 120 patients had postoperative complications. Analysis of the grouped data showed a significant association between body weight and the incidence of complications. There was also a significant association between anaesthesia time and the incidence of complications. The results of this study indicate that patient weight is related to the incidence of complications and the odds of a complication occurring increase by a factor of 1.03 for every one kilogram of increase in patient weight. The period of general anaesthesia also appears to be related to the incidence of complications and the odds of a complication occurring increase by approximately 2% for each additional minute in anaesthesia time. Conclusion: Increasing patient weight and duration of anaesthesia time were found to be risk factors for the incidence of complications of OVH in the bitch.

Schlüsselwörter
Chirurgie, Ovariohysterektomie, Komplikationen, Nebenwirkungen, Kastration

Zusammenfassung

Correspondence to
Lorenzo Muraro
DVM, MRCVS, ECVS Resident
Vet 24 Veterinary Clinic
Via Sorelle Sighel 20
38033 Cavalese (TN)
Italy
Email: lorenzo.muraro@email.it

Komplikationen nach Ovariohysterektomie bei 1880 Hündinnen
Tierärzt Prax 2014; 42 (K): 297–302
Received: November 6, 2013
Accepted after revision: March 12, 2014
Introduction

Canine ovariohysterectomy (OVH) is one of the most commonly performed surgical procedures in companion animal practice (16). It is recommended by many animal welfare organisations for canine population control, and is recognized by the World Health Organization as a means of dog population control as a part of rabies control programmes in rabies-endemic areas (1). Given the frequency with which sterilization procedures are performed, it is not surprising that a number of complications have been described, including haemorrhage, wound healing complications, ovarian remnant syndrome (13), stump pyometra, uterine stump abscess/granuloma formation (7, 18), obstruction (9), ureteral trauma (18–20, 27), inadvertent prostatectomy (28), vaginoperitoneal fistula formation (15), entero-cutaneous fistula formation (12), gossypiboma (12, 21) and urinary incontinence (3, 29). Interestingly, when the incidence of common complications is compared between retrospective studies performed over time, it does not appear that there has been any major reduction in the incidence of common postoperative complications over the past 30 years (5, 6, 11, 22, 25). Techniques for accomplishing surgical sterilization vary widely between geographic areas. A ventral midline approach is a standard technique for canine OVH in the United States, continental Europe and United Kingdom (8, 31–33).

The aim of this study was to determine the frequency and types of complications related to OVH performed on stray dogs by experienced veterinary surgeons from January 2010 to December 2011 in eight dedicated public practices in the north east of Italy (Veneto Region). Specific comparison was made between anaesthesia time, weight of the patient and complications rate. Results were compared with previous studies.

Materials and methods

Patients and operative procedure

The clinical records of all street dogs admitted to the public dog shelters of the Veneto Region (Italy) between January 2010 and December 2011 were reviewed for intact adult bitches admitted to the shelters that underwent OVH as a mean of pet population control. All bitches were subjectively classified as adult; the distinction was based on morphology, dentition and condition. Data recorded for statistical analysis included patient weight, anaesthesia time and complications rate. Results were compared with previous studies. The surgical technique used, with minor variations according to the individual surgeon’s preference, was that described by White (30). Dogs were all examined the day after surgery and before being discharged (which happened always after the end of the 4th week post operation) by the veterinary surgeon that performed the OVH, and postoperative complications were recorded. The skin sutures were routinely removed 10 days after surgery. The owners of dogs given for adoption were requested to seek veterinary assistance if they had any concerns about their pet’s progress after being discharged from the practice and to inform the surgeon for any complications that occurred after the discharge of the patient.

Data handling and statistical analysis

The data were analysed using the statistical software Stata 12.1 (Copyright 1985–2011 StataCorp LP). Several analyses were undertaken to understand if there are differences in anaesthesia time and weight among patients that did have complications, using non parametric tests because of the not normal distribution of continuous data. Basic descriptive statistics were calculated; associations between categorical data were analysed using the chi-squared test or exact Fisher test (time class, weight class, type of complication), while relationships between continuous variables were investigated by Spearman’s rank correlation coefficient (anaesthesia time vs weight). The odds ratio and the relative 95% exact confidence intervals were calculated for categorical data. Levene’s robust test and Wilcoxon (Mann-Whitney) non parametric tests were used for ordinal data to test the hypothesis that two independent samples (bitches with complication vs without) are from populations with the same distribution, while, if there were more than two variables the Kruskal-Wallis test was used (differences between the seven types of complications). Statistical significance relates to a two-sided null hypothesis of no difference, with a critical probability of \( p = 0.05 \).

The odds ratio and the relative 95% exact confidence intervals were calculated to describe the strength of association between two binary/dummies variables.
Results

The data for a total of 1880 bitches undergoing OVH during the 2 year period of 2010 to 2011 were reviewed. Mean ± standard deviation (SD) weight of the bitches was 25.7 ± 6.7 kg. Mean ± SD anaesthesia time was 42.8 ± 8.6 minutes (Table 1).

Complications were recorded in 141 patients corresponding to an overall complication rate of 7.5% (Table 2, Table 3). Twenty-one patients had intraoperative complications and 120 patients had postoperative complications. Distinct types of complications included (Table 4):

Significant ovarian artery haemorrhage occurred in 21 bitches. In all cases the bleeding from the uterine pedicle was identified and arrested intra-operatively; none of these bitches died from intra-operative bleeding.

Haemorrhage from the surgical wound within 6 hours of surgery occurred in nine bitches. Patients were managed by body bandaging and the haemorrhage resolved without further management in all but two dogs. These two bitches continued to bleed from the surgical wound beyond 12 hours postoperatively and exploratory surgery was performed to arrest subcutaneous bleeding.

Wound healing complications occurred in 73 bitches. These complications included incisional swelling, pain and redness with or without discharge (23 bitches), seroma (46 bitches) and incisional hernia within one week of surgery (four bitches). All bitches received clavulanate-potentiated amoxicillin (Synulox®; Pfizer Animal Health) per os for 5 days. Bitches with seroma or incisional hernia underwent surgical revision of the seroma or laparotomy wound; these complications were considered to be resolved at the time of suture removal.

Urinary incontinence at least at one occasion whilst the bitch was asleep or recumbent reported within 4 weeks of the surgery was recorded in 36 bitches. No further diagnostic procedure and treatment were performed due to economic restriction.

Ovarian remnant syndrome (ORS) resulting in pseudopregnancy, including mammary enlargement and lactation, were recorded in two bitches when examined by a veterinarian within 12 months postoperatively.

Analysis of the grouped data showed a significant association between weight and the incidence of complications although the weight difference was very low (medians: 27 kg vs 25 kg). There was also a significant association between anaesthesia time and incidence of complications but again the difference was small (medians: 42 minutes vs 40 minutes). Nonparametric test such as Spearman’s rank correlation coefficient and Bootstrap regression showed a positive correlation between weight and anaesthesia time, which was higher when only the bitches with complications were considered.

Analysis of data for the bitches with complications (n = 141) showed no significant difference between the median weights by type of complication as well as the median anaesthesia time by type of complication. There was no significant difference between

<table>
<thead>
<tr>
<th>Weight (kg)</th>
<th>Anaesthesia time (min)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Minimum</td>
<td>15</td>
</tr>
<tr>
<td>Maximum</td>
<td>40</td>
</tr>
<tr>
<td>Mean</td>
<td>25.7</td>
</tr>
<tr>
<td>Standard deviation</td>
<td>6.7</td>
</tr>
<tr>
<td>p25</td>
<td>20</td>
</tr>
<tr>
<td>p50</td>
<td>25</td>
</tr>
<tr>
<td>p75</td>
<td>30</td>
</tr>
<tr>
<td>Interquartile range = p75 – p25</td>
<td>10</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Weight class</th>
<th>Complication</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Absence [n (%)]</td>
<td>Presence [n (%)]</td>
</tr>
<tr>
<td>15–19 kg</td>
<td>376 (91.7%)</td>
<td>34 (8.3%)</td>
</tr>
<tr>
<td>20–24 kg</td>
<td>406 (94.6%)</td>
<td>23 (5.4%)</td>
</tr>
<tr>
<td>25–29 kg</td>
<td>495 (94.1%)</td>
<td>31 (5.9%)</td>
</tr>
<tr>
<td>30–34 kg</td>
<td>248 (89.9%)</td>
<td>28 (10.1%)</td>
</tr>
<tr>
<td>35–40 kg</td>
<td>214 (89.5%)</td>
<td>25 (10.5%)</td>
</tr>
<tr>
<td>Total</td>
<td>1739 (92.5%)</td>
<td>141 (7.5%)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Anaesthesia time class (min)</th>
<th>Complications</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Absence [n (%)]</td>
<td>Presence [n (%)]</td>
</tr>
<tr>
<td>30–34 min</td>
<td>144 (91.7%)</td>
<td>13 (8.3%)</td>
</tr>
<tr>
<td>35–39 min</td>
<td>701 (93.8%)</td>
<td>46 (6.2%)</td>
</tr>
<tr>
<td>40–44 min</td>
<td>280 (93.3%)</td>
<td>20 (6.7%)</td>
</tr>
<tr>
<td>45–49 min</td>
<td>200 (88.5%)</td>
<td>26 (11.5%)</td>
</tr>
<tr>
<td>50–54 min</td>
<td>227 (95.4%)</td>
<td>11 (4.6%)</td>
</tr>
<tr>
<td>55–59 min</td>
<td>71 (83.5%)</td>
<td>14 (16.5%)</td>
</tr>
<tr>
<td>60–65 min</td>
<td>116 (91.3%)</td>
<td>11 (8.7%)</td>
</tr>
<tr>
<td>Total</td>
<td>1739 (92.5%)</td>
<td>141 (7.5%)</td>
</tr>
</tbody>
</table>
the median weights of the bitches with complication during surgical intervention towards those after surgical intervention.

Grouped data shows a significant association between anaesthesia time class/weight class and presence of complications (Table 2, Table 3), even if Cramer’s V is close to 0 (0 corresponding to no association between the variables) and far from 1 (1 means complete association).

Discussion

Although many techniques have been described, the most widely performed procedure is a midline laparotomy for both ovariec-
tomy (OE) and OVH. Irrespective of the abdominal procedure, the laparotomy itself can have the same complications and its potential complications are well recognized (4, 25). In addition, there are specific complications related to this surgical procedure and the complications associated with the procedure have been reported (11, 17, 24, 26).

Haemorrhage is a preventable complication of OVH but is re-
ported as the most common cause of death after OVH (23). Pre-
vious retrospective analysis of OVH reported a rate of intra-ope-
rative haemorrhage ranging from 4% to 9% (6, 11). In the present study, haemorrhage occurred during the operation in 21 dogs (11.1%) and was successfully addressed intra-operatively by the sur-
geon in all cases. The retrospective analysis shows that there was no strong statistically significant correlation between anaesthesia time or the weight of the patient and the probability of intra-operative haemorrhage from the ovarian vessels. Large deposits of abdominal fat in obese animals may hinder access to the ovaries and complicate ligation of the ovarian pedicles, stray dogs however tend not to be obese. Therefore, the lower complication rate that we recorded compared to previous studies could be related not just to absolute body weight but to body condition. Unfortunately, the patients’ body condition score was not recorded.

Haemorrhage from the surgical wound within 6 hours postop-
eratively occurred in nine bitches representing a complication rate of 0.5%; this is somewhat lower than the value of 0.7% reported by Burrow and others (6). The median weight of the patients that developed this type of complication (mean 29.5 kg, median 32 kg) was higher than the median weight of the dog population of the study (median 25 kg) and the median anaesthesia time for these dogs (mean 42.8 minutes, median 46 minutes) was longer than the anaesthesia time of the dog population (median 40 minutes). De-
spite this, there was no statistically significant correlation between the patient weight or the anaesthesia time and the incidence of this type of complication.

Problems associated with incisional healing are some of the most frequently reported complications following OVH surgery and although somewhat under emphasised in most textbook de-
scriptions of elective sterilization surgery, the incidence of this complication far exceeds the incidence of intra-operative haemorrhage (6). The incidence of incisional swelling, wound infection and abdominal dehiscence does not appear to have decreased over the past 40 years despite improvements in technique and available suture. Dorn and Swist (11) reported the postoperative wound complication rate for OVH performed by students and veterinary surgeons being 23%. Development of wound complications has also been related to the duration of surgery, with an increased inci-
dence of postoperative swelling and wound infections occurring following surgeries that lasted longer than 90 minutes and in an-
esthetic episodes lasting longer than 120 minutes (6). We had a wound healing complication rate of 3.9%; in the present study, however, none of the patients was anaesthetised for longer than 120 minutes, which may explain the relatively low complication rate related to incisional wound healing.

Wound infections occur with a similar rate after elective OVH as in the general population undergoing elective surgery and ranges from 2.2% to 5.7%, with a significant and positive corre-
lation to anaesthesia and surgery time (6, 22, 25). In veterinary medicine the infection of the surgical site postoperatively is most commonly defined in terms of the presence of a purulent dis-
charge, either with or without inflammation, although other defi-
nitions have been used (4). In the present study 73 dogs had wound healing complications, of which 23 displayed incisional swelling, pain and redness (1.2%), 46 had seroma formation along the ventral midline (2.5%) and four dogs had incisional hernia (0.2%). Seroma formation along the ventral midline is a quite common complication due to the dependent location of the wound, which facilitates collection of fluid. This complication must be distinguished from the subcutaneous swelling that is as-
associated with more serious abdominal wall dehiscence and herni-
ation. Ventral midline incisional hernia is extremely rare, occurring in less than 1% of over 2000 cases of elective sterilization sur-
ery (25). Our retrospective study reported four cases of incisional hernia (0.2%) which were diagnosed by palpation and confirmed with plain radiography. Two dogs were affected by self-induced trauma. In the other two cases the abdominal wound was intact.

### Table 4 Complications recorded after ovariohysterectomy in 1880 bitches.

<table>
<thead>
<tr>
<th>Complications</th>
<th>Dogs</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Haemorrhage from the ovarian artery</td>
<td>21</td>
<td>1.12%</td>
</tr>
<tr>
<td>Haemorrhage from the surgical wound</td>
<td>9</td>
<td>0.48%</td>
</tr>
<tr>
<td>Incisional swelling, pain, redness</td>
<td>23</td>
<td>1.22%</td>
</tr>
<tr>
<td>Seroma</td>
<td>46</td>
<td>2.45%</td>
</tr>
<tr>
<td>Incisional hernia</td>
<td>4</td>
<td>0.21%</td>
</tr>
<tr>
<td>Incontinence</td>
<td>36</td>
<td>1.91%</td>
</tr>
<tr>
<td>Ovarian remnant syndrome</td>
<td>2</td>
<td>0.11%</td>
</tr>
<tr>
<td>None</td>
<td>1739</td>
<td>92.5%</td>
</tr>
<tr>
<td>Total</td>
<td>1880</td>
<td>100.0%</td>
</tr>
</tbody>
</table>
and therefore repaired on a semi-elective basis. Abdominal incisional hernia that occurs during the first 7 days after surgery is most commonly due to technical errors, including failure to incorporate the external rectus fascia, inappropriate suture size, or knot failure. Many of these technique errors can be avoided by use of proper surgical technique. Most textbook recommend clearing of subcutaneous tissues from the external rectus fascia for approximately 1 cm on either side of the linea alba to facilitate proper incorporation of the external rectus fascia during closure. The linea may be closed in either a continuous or an interrupted appositional suture pattern, using monofilament suture material.

Perioperative antibiotics are not commonly recommended during OVH procedures, although the surgery is classified as a clean contaminated procedure (6). The patients of the present study had no routine antibiotics administered in the postoperative time. The dogs were also kennelled straight after recovering from general anaesthesia, with no monitoring and no bandages applied to the wound. None of the dogs that developed complications had protective collars placed. This lack of postoperative care could have increased the incidence of postoperative incisional wound complications.

Ovarian remnant syndrome (ORS) is the persistence of functional ovarian tissue following OVH or ovarioectomy giving rise to signs of oestrus, and rarely pseudopregnancy as the result of inappropriate OVH technique. ORS is predisposed by inadequate exposure of the ovarian pedicles resulting in poor visualization, inaccurate placement of clamps or ligatures, or accidental separation of a portion of the ovary with subsequent loss of the tissue in the abdomen, which is not a likely cause as most ovarian remnants are found at the ovarian pedicle. Although it is possible that there may have been some underreporting in the study, the incidence of ORS, confirmed by the presence of signs of oestrus and vaginal cytology was extremely low at 0.11%.

Urinary incontinence as a complication of OVH may occur immediately after surgery, although very unusual, or as long as 12 years postoperatively, with an average interval of approximately 3 years and has been reported to occur in as many as 11–20% of dogs undergoing OVH (3). Small breed dogs appear to be at lower risk, whereas large and giant breeds appear to be at higher risk (3). Although our study did not look at the long-term incidence of this complication, 36 bitches (1.9%) suffered from at least one episode of urinary incontinence within 4 weeks of the surgery, which could have also been caused by cystitis. Unfortunately no specific diagnostic tests were performed to differentiate between true incontinence or cystitis causing the episodes.

The results of this study indicate that patient weight is related to the incidence of complications and the odds of a complication occurring increase by a factor of 1.03 for every one kilogram of increase in patient weight. In the present study the absolute weight of the patient therefore appears to be a risk factor for complications although future studies might focus on differentiating absolute weight from body condition.

**Conclusion for practice**

Increasing patient weight and duration of anaesthesia time were found to be risk factors for the incidence of complications of ovariohysterectomy. Although patient weight is difficult to influence, surgeons can impact operative duration.

The period of general anaesthesia also appears to be related to the incidence of complications and the odds of a complication occurring increase by approximately 2% for each additional minute in anaesthesia time. In the present study, surgical expertise was thought to be the factor most likely to be responsible for lowering the anaesthesia time and thereby decreasing the overall complication rate for the patients undergoing elective OVH.

**Conflict of interest**

The authors confirm that they do not have any conflict of interest.

**References**


Meldung

ESCCAP-Checkliste für Hunde aus dem Ausland


Die parasitologische Expertenorganisation ESCCAP (European Scientific Counsel Compa- nion Animal Parasites) hat daher jetzt eine praktische Übersicht erstellt, die kurz und verständlich aufzeigt, welche Untersuchungen und Behandlungen bei welchem Hund empfohlen sind. Diese Checkliste kann ab sofort kostenfrei auf der ESCCAP-Internetseite eingesehen, heruntergeladen und/oder ausgedruckt werden: www.esccap.de.