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Surgical and Postoperative Complications of Prepubertal Ovariohysterectomy in Dogs

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Abstract: In this study, a total of 25 clinically healthy, six to eight week old, mixed breed female puppies were used to investigate the surgical and postoperative complications of ovariohysterectomy performed at 10 weeks of age. Fourteen animals were completely ovariohysterectomized (group Po) in a routine manner and eleven animals were sham operated (group Lp). No deaths occured during the surgical procedures whereas three puppies died during postoperative period because of infectious diseases. In group Po, two animals had both surgical and postoperative complications whereas five animals had only postoperative complications. In group Lp, no surgical complications occured but two of eleven puppies had postoperative complications. Of all the animals that participated to the study, 36% had complications and 64% did not have any complication. No significant differences were observed in the number of surgical and postoperative complications between the groups except suture reaction or incisional swelling ($p<0.01$). Apart from the infectious diseases that resulted with death, no other postoperative complications required a medical treatment.These findings suggest that, in dogs, complete ovariohysterectomy with proper anesthetic and surgical techniques performed at 10 weeks of age is a safe and reliable contraception method.

Key words: Anesthesia, puppy, spaying, surgery

INTRODUCTION

Surgical sterilization of female companion animals which consists of ovariectomy or ovariohysterectomy is a routine abdominal surgery in many European countries. Altough gonadectomy is one of the oldest surgical procedure in domestic animals, the age at the surgery is still a dilemma (Salmeri *et al*., 1991). Current practice in Europe is that bitches are spayed after six months of age or after the first estrus whereas in the United States the surgery is most commonly performed between 5 and 8 months of age (Farstad, 2004). Unfortunately, scientific knowledge related to the ideal age for the elective surgery does not exist (Salmeri *et al*., 1991).

Prepubertal gonadectomy or early-age spaying/ neutering is the surgical sterilization of sexually immature male and female animals aging from 6-to-14 weeks which was supported by several organizations including American Veterinary Medical Association (AVMA), American Humane Association (AHA) or American Animal Hospital Association (AAHA) (Kahler, 1993; Kustritz, 1999). In the United States it has been proposed as a tool to combat pet overpopulation problem where millions of companion animals are destroyed annually (Salmeri *et al*., 1991).

In dogs, previous studies either demonstrated the anesthetic and surgical complications of prepubertal gonadectomy or made a comparison of these complications between early-age spaying and traditional-aged gonadectomy (Theran, 1993; Fagella and Aronsohn, 1994; Howe, 1997). However up to this study, no studies compared the complications of the surgery with a control group in the same age.

The objective of the present study was designed to determine the surgical and postoperative complications that developed in puppies underwent ovariohysterectomy at the age of 10 weeks and to compare the results with the results obtained from the sham operated puppies.

MATERIALS AND METHODS

Animals and study design: A total of 25, six to eight week old, mixed breed female puppies from five different medium sized bitches were used in this study. The puppies were housed with their littermates in an indoor facility and were individually fed dry dog food (ANF Advantage Puppy, ANF Specialities, USA) twice daily according to the suggestions of the company. Water was provided *ad libitum*. Prior to the surgeries pups were treated with piperazine (100 mg kg^{-1}, PO, Helmipar Surup, Saba Ilac Sanayii, Turkey) and fipronil (Frontline Spray, Merial, Lyon, France) and were vaccinated against infectious diseases (CoughGuard® B, Vanguard® Plus 5, Defensor® 3, Pfizer Animal Health, Exton, PA, USA).

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Surgeries: The puppies from the same litter were randomly placed into two groups and the surgeries were performed at 10 weeks of age. Group prepubertal ovariohysterectomy (Po) consisted of 14 animals that were completely ovariohysterectomized and group Laparotomy (Lp) consisted of 11 animals that had the same procedures as group Po except removal of both ovaries and the uterus. On the day of surgery, a complete physical examination was performed on each animal and food was withheld for 3 to 5 hours before induction of anesthesia. Anesthesia was induced by mask administration of isoflurane (Isoflurane, Rhodia Organique Fine Ltd., UK) and oxygen with a premedication of atropine (0.04 mg kg^{-1} SQ, Atropin, Vetas, Turkey) and carprofen (4 mg kg^{-1} SQ, Rimadyl, Pfizer, Belgium).

The animals were intubated with 2.0-to-4.0-mm/ID cuffed endotracheal tubes (Rüsch, Germany) and maintained on isoflurane and oxygen. After the maintenance of anesthesia, the ventral abdomen was minimally shaved and prepared for surgery with warm chlorhexidine solution diluted with saline solution. Warm Lactated Ringer solution was administered through a 22-gauge cephalic catheter at the rate of 4 mL kg^{-1} of body weight per h. Supplemental heat was provided by containers filled with warm water during the surgery. After the surgery, each puppy was kept in a warm and quiet place and a small portion of food was offered 2 h after extubation.

Surgical procedures: During the surgeries heart and respiratory rates of each animal were recorded every five minutes. The ventral midline skin incision was made 2-3 cm caudal to the umblicus and the linea alba was exposed. A hole was made on the fibrous linea alba by scalpel blade and the subcuticular layer, the abdominal muscles and peritoneum were incised. The uterus was easily found by the use of two tissue forceps and one horn of the uterus was followed cranially to find the ovary. The suspansory ligament was ligated using 2-0 chromic catgut (Chromic Catgut, Orhan Boz, Turkey) and a mosquito hemostat was placed on the proper ligament. Then, the ovary was released after the dissection of the broad ligament. The same procedure was repeated on the opposite ovary. A ligature was placed at junction of the uterine body and cervix to remove the uterine body and both ovaries. The abdominal cavity was examined for evidence of hemorrhage after the removal of the reproductive organs (Fig. 1). The removed tissues were examined to ensure the complete removal of both ovaries and the uterine body to avoid the development of any pathology. The ventral fascia and subcuticular layer were closed with s imple interrupted suture using 2-0 chromic catgut and the skin sutures were placed using 2-0 silk (Silk, Orhan Boz, Turkey) in an interrupted suture pattern.

Fig. 1: The reproductive organs of a puppy

The sham surgery followed the same protocol as gonadectomy, excluding ovary and uterus removal.

Surgical and postoperative complications: During the surgeries, the animals were closely monitored and surgical complications including death, apnea, cardiac arrest, abdominal hemorrhage, loosening ligature, leaving an ovary and perioperative regurgitation were recorded.

The twelve days following each surgery constituted the postoperative period and complications investigated during this period consisted of death, diarrhea, anorexia, vomiting, lethargy, incisional swelling or suture reaction, respiratory disease, suture removal by puppy, serum collection, incisional haematoma, incisional hemorrhage, peritonitis and dehiscence.

Statistical methods: All analyses were performed by the use of statistical packages for social sciences 11.5 package program (SPSS, 2004). χ^2 test was used to compare the differences between the groups for the surgical and postoperative complications. A value of $p<0.05$ was considered to be statistically significant.

RESULTS AND DISCUSSION

All the animals well tolerated the surgeries and no deaths occurred during the surgeries. Two animals from group Po (both on postoperative 10th day) and one animal from group Lp (postoperative 11th day) died after the surgery because of infectious diseases. Seven out of the fourteen animals (50%) in group Po had complications. The nature of these complications were as follows; five animals had postoperative and two animals had both surgical and postoperative complications. Seven animals

(50%) showed no complications at all. Two out of the eleven animals (18%) in group Lp showed complications of postoperative nature. No surgical complications occured in this group. The remainning nine animals (82%) showed no complication at all. Of all the animals that constituted group Po and Lp, 36% had complications and 64% did not have any complications. The number of surgical and postopeative complications observed in this study are given in Table 1 and 2. No significant differences were found in the number of surgical and postoperative complications between the groups except suture reaction or incisional swelling ($p<0.01$).

In the present study, we investigated anesthetic and surgical complications of early age spaying in dogs and compared the number of complications developed in early age ovariohysterectomized group with the number of complications observed in control group.

Tight-fitting mask with isoflurane and oxygen enabled the animals to be intubated easily in 5 to 10 min without any complications. Our observations were in accordance with those reported by Stubbs *et al.* (1996) that mask induction with isoflurane without premedication results with easy intubation and minimal restraint of animals. During anesthesia, two puppies from group Po developed transient apnea which were managed by ceassation of isoflurane flow and providing artificial ventilation without the administration of any respiratory stimulant.

Abdominal hemorrhage due to accidental cutting of mesenteric vessels in one animal was the only complication related to surgical technique. The

Table 1: The number of surgical complications observed in group Po and Lp

Complication	Group Po	Group Lp
Death	0	0
Apnea	2	0
Cardiac arrest	0	0
Abdominal hemorrhage	1	0
Loosening ligature	0	0
Leaving an ovary	0	0
Perioperative regurgitation	0	0

Table 2: Distribution of postoperative complications in group Po and Lp

Complication	Group Po	Group Lp
Death	2	1
Diarrhea	1	1
Anorexia	2	2
Vomiting	0	0
Lethargy	2	1
Incisional swelling or Suture reaction	5	0
Repiratory disease	1	1
Suture removal by the puppy	1	0
Serum collection	4	0
Incisional haematoma	2	0
Incisional hemorrhage	1	0
Peritonitis	0	0
Dehiscence	0	0

frequency of anesthetic and surgical complications and the number of fatalities as a result of these complications were higher in the study by Howe (1997) which may be due to surgical experience of veterinary students in the study. In another study (Fagella and Aronsohn, 1994), tearing of the proper ligament and seperation of the ovary from uterus was reported in two puppies. Our results are consistent with those of other studies (Aronsohn and Faggella, 1993; Stubbs *et al.*, 1996) in which surgical complications were minimal.

None of the postoperative complications required medical treatment or resulted with death except infectious diseases such as respiratory tract disease. Infectious diseases were developed in three puppies during the postoperative period despite the fact that all animals were dewormed and vaccinated prior to surgeries. The source of the puppies in this study was animal control and care facilities where hundreds of dogs and cats are housed together and the transmission of infectious diseases is easy. Alike our study, infectious diseases caused fatalities in eight animals in the study by Howe (1997). However, Spain *et al.* (2004) demonstrated that age at gonadectomy was not associated with diseases that require long-term immune suppression including parvoviral infection, demodicosis, infectious tracheobronchitis or repeated infections of the same body system. In addition, Howe *et al.* (2001) indicated the importance of the duration of the stay in animal shelters before prepubertal ovariohysterectomy in the development of infectious diseases. Most puppies that stayed in animal shelters for longer periods developed parvoviral enteritis (Howe *et al.*, 2001).

As in previous reports (Aronsohn and Faggella, 1993; Theran, 1993; Fagella and Aronsohn, 1994; Stubbs *et al.*, 1996; Howe, 1997) complications related to skin incisions were the most common postoperative complications determined in this study. This may be due to the closure of the skin by use of silk material although no short-term reactions were observed when the skin was closed with silk (Auerbach and Pearlstein, 1975). Another factor may be too tight placing of the skin sutures since we were not very much experienced in skin suturing at this age group. However, incisional complications were also reported by other studies (Aronsohn and Faggella, 1993; Theran, 1993) in which the use of skin sutures were avoided by closing only the subcuticular layer in a continuous intradermal pattern.

Although the number of overall complications determined in this study might be seen higher than the previous studies (Pollari *et al.*, 1996; Howe, 1997) the major complications that resulted with death or required medical or surgical treatment such as drug overdose,

dehiscence, incisional infection, bleeding, cardiac arrest, peritonitis or severe infectious diseases were absent or less occurred compared with the mentioned studies. In addition, complications reported in adult ovariohysterectomies including delayed wound healing, suture abscesses, dehiscence, suture infections, secondary hydronephrosis, ureterovaginal fistula, flank fistulas, granulomas of uterine or ovarian stump and ovarian remnant syndrome did not occur in this study (Turner, 1972; Pearson, 1973; Dorn and Swist, 1977; Okkens *et al*., 1981a-b; Miller, 1995; Pollari *et al*., 1996).

CONCLUSION

Our findings in this study indicate that prepubertal ovariohysterectomy performed at 10 weeks of age does not increase the risk of complications related to anesthesia or surgical technique. This study is the first to compare the anesthetic and surgical complications of prepubertal ovariohysterectomy with a laparotomy group in dogs.

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