Journal of Entomology and Zoology Studies

Available online at www.entomoljournal.com

E-ISSN: 2320-7078
P-ISSN: 2349-6800
www.entomoljournal.com
JEZS 2020; 8(4): 872-877

Received: 28-05-2020
Accepted: 30-06-2020

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Comparative evaluation of three different laparotomy approaches for ovariohysterectomy in bitches

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Abstract
The study was carried out to compare three different laparotomy approaches for ovariohysterectomy in bitches. The animals were divided into three groups based on laparotomy approaches for ovariohysterectomy are Group I (Ventral abdominal midline), II (Right flank) and III (Left flank) consisting of 6 animals each. The following parameters were studied viz., length of surgical incision, operative haemorrhage, ease of exteriorization of uterus and ovaries, ease of ligation of uterus and ovaries, duration of operation and cost of surgery (length of suture materials), wound appearance, duration of wound healing and post operative herniation / evisceration. The mean length of surgical incision (cm) was 8.17 ± 0.65, 4.88 ± 0.44 and 5.07 ± 0.34 for Group I, Group II and Group III respectively. The length of surgical incision was comparatively less in right flank approach. The mean duration of operation (min) was 44.25 ± 3.50, 40.5± 2.88 and 42.17 ±2.18 in Group I, Group II and Group III respectively. The mean duration of wound healing (days) was 14.17 ± 1.38, 10.17 ± 0.31 and 11.67 ± 0.56 in Group I, Group II and Group III respectively. Minimum duration of wound healing and uneventful recovery was observed in Group II. It is concluded that ovariohysterectomy through Right flank laparotomy is superior to other two approaches due to less duration of surgery, less suture material required, faster wound healing and minimum post operative complications.

Keywords: Bitches, left flank, ovariohysterectomy, right flank, ventral abdominal midline

Introduction
Dogs are considered as essential elements of the modern society as they act companion to human beings and used extensively by the police and army department. These valuable animals often suffer from different reproductive ailment like pyometra, mammary gland tumour, ovarian cyst, cystic endometrial hyperplasia and many others. To prevent these conditions and unwanted pregnancy, veterinarian advice pet owners for spaying their pet. Ovariohysterectomy is an ablation of both ovaries and uterus of a female dog to make her unable to reproduce and is one of the most common surgical procedures in small animal practice. It is also known as spaying and recommended by many animal welfare organizations 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 (WHO) [17]. It is done as a method of contraception to prevent the uncontrolled breeding as well as to prevent and treat diseases associated with reproductive system viz., ovarian cyst, cystic endometrial hyperplasia pyometra complex, metritis, uterine torsion, uterine prolapse and uterine rupture resulting in inconvenience to pet owner [4]. It is also indicated to prevent recurrence of vaginal hyperplasia, hormonal changes that can interfere with medication in diabetic or epileptic dogs and decrease the incidence of mammary gland tumour [14]. The signs of estrus in bitches are the major causes of inconvenience to the pet owners and they seek veterinary advice. Ovariohysterectomy includes prevention of estrous and associated problems such as bloody vaginal discharge, behavioral change, nuisance of male dogs being attracted, undesired mating, pseudo and unwanted pregnancy [7]. The long-established age for spaying in dogs has been around 8 to 10 months, either before or after their first estrous. Surgery should not be performed during heat because of increased blood supply to the uterus and in case of false pregnancy. Therefore, the best time to perform spay is usually about three months after a season has finished.

Non-surgical and surgical sterilization techniques are practiced in dogs to make them unable to reproduce. Hormones and chemicals are used as non-surgical method of sterilization. Several authors have reported drawbacks of using hormones and chemicals. Laparoscopic technique for ovariohysterectomy has been described but is not widely used. Ovariectomy, ventral abdominal midline laparotomy and lateral flank laparotomy are the common surgical sterilization techniques in dogs [1]. Traditionally ovariohysterectomy is performed through ventral midline incision in bitches. Considering the difficulties encountered in ventral midline approach such as evisceration, delayed healing, herniation etc, a suitable alternative method of ovariohysterectomy by lateral flank method came in to existence. The main advantages of lateral flank method for ovariohysterectomy include the possibility to observe the surgical wound from a distance without handling of animal and reduced potential for evisceration of abdominal organs in cases of suture dehiscence [8]. On a lactating animal, using the lateral flank approach can avoid potential complications that may be associated with the ventral midline approach, such as excessive hemorrhage from the skin and subcutaneous tissue, wound inflammation or infection and leak-age from mammary tissue [11]. Thus, lateral flank approach was proposed as an alternative to the conventional ventral midline ovariohysterectomy. McGarth *et al*. [9] reported that right flank laparotomy offers improved access to the more cranially located right ovary and when approached from left the omentum covers the viscera. There is very little information in the literature regarding comparative evaluation of ventral midline, right and left laparatomy approaches for ovariohysterectomy in bitches. Therefore, the present study was undertaken to compare three different laparatomy approaches for ovariohysterectomy in bitches.

Materials and Methods

The present study was conducted in the Department of Veterinary Surgery & Radiology, College of Veterinary Science & A. H., Anjora, Durg (C.G.). Eighteen apparently healthy female dogs were selected for surgery between eight months to 5 years. They were randomly divided into three equal groups that are Group I, II and III consisting of six animals in each group. Ovariohysterectomy performed in Group I by ventral midline laparotomy, Group II by right flank laparotomy and Group III by left flank laparotomy along with post operative care. Anaesthetic regimen of Atropine Sulphate @ 0.04 mg/kg intramuscularly, Xylazine Hydrochloride @ 1 mg/kg body weight intramuscularly and Ketamine Hydrochloride @ 5 mg/kg body weight intravenously was given to animals in all the three groups. In order to evaluate the best approach for ovariohysterectomy, various parameters such as length of surgical incision, operative haemorrhage, ease of exteriorization of uterus and ovaries, ease of ligation of uterus and ovaries, duration of operation and cost of surgery (length of suture materials), wound appearance, duration of wound healing and post operative herniation / evisceration was studied and compared between different groups.

Pre-operative preparation

Animals were fasted for 12 hours and water withheld for 6 hours prior to surgery. After complete clinical examinations of the animals, they were subjected to surgical treatment. Surgical area for right flank, left flank and ventral midline approaches was prepared aseptically by clipping the hairs, surgical site scrubbed with Chlorhexidine solution, shaved and painted with 7.5% povidone iodine solution.

Surgical Procedure

Group I- Ventral midline laparotomy approach

The animals were positioned on dorsal recumbancy after general anaesthesia and ventral abdomen (from xiphoid to os pubis) was prepared for aseptic surgery (Fig.1). Incision was made caudal to the umbilicus in the cranial third of the caudal abdomen. Skin, subcutaneous tissue, linea alba and peritoneum were incised. The finger was slided against the abdominal wall, 2-3 cm caudal to the kidney and uterine horn was grasped with finger which was confirmed by uterine bifurcation or ovary (Fig.2). Triple clamping was done to ovarian pedicle and tranfixation ligature applied using Catgut No. 1. Ovarian pedicle was severed between the clamp closure to the ovary and the middle one. The pedicle was carefully observed for haemorrhages and then gently dropped into abdominal cavity. The same procedure was repeated for the other ovary. Three clamps were placed on the uterine body just cranial to the cervix. Both the uterine arteries were ligated separately caudal to the most caudal clamp. The uterine body was severed between the proximal and middle clamps. The caudal clamp was removed and transfixation of uterine end was done just cranial to the cervix using chromic catgut No. 1 in the groove. The pedicle was checked for haemorrhage after removing the clamps. The pedicle was gently replaced in to the abdominal cavity after removal of the haemostat. The genitalia were taken out with the clamps attached to three ends. The abdominal wound was sutured in three layers comprising aponeurotic abdominal muscles with peritoneum, subcutaneous tissue and the skin. The suture material utilized was chromic catgut No 1 for ligation, petcryl No. 1 for abdominal muscles and subcutaneous tissue and silk No. 1 for skin. The technique of suturing was lock stitch for first layer involving peritoneum followed by simple continuous and simple interrupted for abdominal muscle and skin respectively.

Fig 1: Dorsal recumbency /Ventral midline laparotomy approach

Fig 2: Exteriorization of uterus and ovary in ventral midline laparotomy approach

Group II- Right flank laparotomy approach

The animals were taken to left lateral recumbency after general anaesthesia. Right flank (from last rib to pin bone) was prepared aseptically (Fig. 3). An oblique skin incision was made, at angular junction between two to three finger widths from last rib and ventral to the transverse processes of lumbar vertebrae in downward and backward direction, taking care to avoid superficial vessels located near the ventral aspect of the flank. The abdominal muscles were separated layer by layer to reach the abdominal cavity. The right uterine horn was grasped with finger (Fig. 4.). Further same procedure was followed as that to ventral midline laparotomy approach.

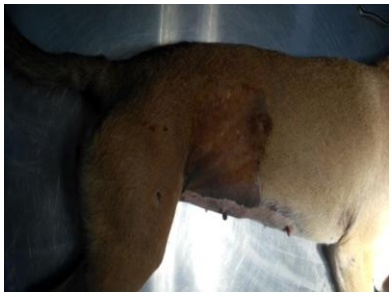

Fig 3: Left lateral recumbency / Right flank laparotomy approach

Fig 4: Exteriorization of uterus and ovary in right flank laparotomy approach

Group III-Left flank laparotomy approach

The animals were taken to right lateral recumbency after general anaesthesia and left flank (from last rib to pin bone) was prepared aseptically (Fig. 5.). An oblique skin incision was made, at angular junction between two to three finger widths from last rib and ventral to the transverse processes of lumbar vertebrae in downward and backward direction, taking care to avoid superficial vessels located near the ventral aspect of the flank. The abdominal muscles were separated layer by layer to reach the abdominal cavity. The right uterine horn was grasped with finger (Fig.6.). Further same procedure was followed as that to ventral midline laparotomy approach.

Fig 5: Right lateral recumbency / Left flank laparotomy approach

Fig 6: Exteriorization of uterus and ovary in left flank laparotomy

Post Operative Care

Post operatively, dogs were given intravenous fluid therapy, antibiotic (Taxim), analgesic (Melonex) and supportive therapy (Tribivet) for five days. Antiseptic dressing was done with povidone iodine and lorexane ointment. Tight abdominal bandaging was done and owners were advised for applying Elizabethan collar around neck and maintain liquid diet for few days

Statistical analysis

Data obtained was analyzed by using Analysis of Variance (ANOVA) as per standard procedure outlined by Snedecor and Cochran [15] using computerized statistical package SPSS 17 and represented in Mean ±S. E.

Results and Discussion

a. Length of surgical incision

The values (Mean ± SE) regarding length of surgical incision (cm) in animals of different treatment groups are represented in Fig. 7. The mean length of surgical incision (cm) was 8.17 ± 0.65, 4.88 ± 0.44 and 5.07 ± 0.34 in Group I, Group II and Group III, respectively. The length of surgical incision was significantly (p<0.05) more in Group I as compared to Group II and Group III. However, length of surgical incision exceeded non significantly evident animals of in Group III as compared Group II. Minimum length of surgical incision was Group II (right flank). Murthy *et al.* [10] reported mean length of surgical incision (cm) for ventral midline approach and flank approach as 2.05 ± 0.22 and 1.10 ± 0.06 respectively. The length of surgical incision was significantly higher in ventral midline as compared to flank approach. However, Reece *et al.* [13] recorded surgical incision length for right flank laparotomy as 22 mm.

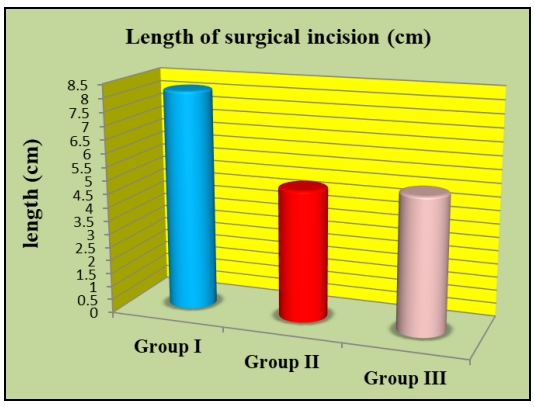

Fig 7: Mean value of length of surgical incision (cm) in different treatment groups

b. Operative haemorrhage

Operative haemorrhage in animals of different treatment groups are depicted in Table 1. The haemorrhage observed during surgery was less in animals of Group I (2+ in two animals and 1+ in four animals) as compared to Group II (3+ in two animals and 2+ in four animals) and Group III (3+ in three animals and 2+ in three animals). In present study, minimum haemorrhage was observed in Group I (ventral midline). To its contrary, Murthy *et al.* [10] recorded mild haemorrhage in flank approach which may be attributed to right technique for separation of muscle fibers while entering the abdomen. In present study, haemorrhage was seen more in both flank approaches as compared to ventral midline which could be due to muscle trauma and injury to supplying blood vessels.

Table 1: Operative haemorrhage in animals of different treatment groups

Number of animals	Group I	Group II	Group III
1	2+	3+	3+
2	2+	3+	3+
3	1+	2++	3+
4	1+	2++	2+
5	1+	2++	2+
6	1+	2++	2+

1+ indicates mild haemorrhage; 2+ indicates moderate haemorrhage; 3+ indicates severe haemorrhage

c. Ease of exteriorization of uterus and ovaries

In the present study, exteriorization of uterus and ovaries was easy in Group II (right flank) and Group III (left flank) while it takes little more time to locate uterus and ovaries in Group I (ventral midline). McGrath *et al.* [9] preferred the right flank approach because it was easier to acess the more cranially located right ovary as the omentum covers the viscera when approached from left flank. Similarly, Devi *et al.* [5] reported that pus filled enlarged uterus could be exteriorized easily through smaller flank incision, as the loose skin and muscle in the flank could be manipulated as per requirement whereas midline incision needed to be longer. With a flank incision, the ipsilateral ovary and uterine horn lie immediately below the incision, making them very easy to locate and this eliminates some of the time, normally required to locate an ovary using the ventral midline approach [2].

d. Ease of ligation of uterus and ovaries

In Group I and Group II, ligation of uterus and ovaries was easy as compared to Group III. In Group III, there is slight difficulty in ligating right ovary. This could be due to anatomical location of right ovary which is placed more cranially as compared to left ovary. Similarly, Slatter [14] documented that right ovary is incompletely removed more often than the left ovary. Dorn [6] preferred right flank over left flank for the reason that the right ovary is located farther cranially than the left ovary in dogs and the approach on this side permits better access to the ovary, require less time and reduced chance of wound dehiscence.

e. Duration of operative procedure

The values (Mean ± SE) of duration of operative procedure (minutes) in animals of different treatment groups are represented in Fig. 8. The mean time (min) for successful operative procedure was 44.25 ± 3.50, 40.5± 2.88 and 42.17 ±2.18 in Group I, Group II and Group III, respectively. These findings are in agreement with Vandana [16] and Pukacz *et al.* [12] for conventional ovariohysterectomy either by flank or by mid ventral midline method. Murthy *et al.* [10] also reported mean operative time in ventral midline and flank approach as 11.50 ± 0.42 and 7.16 ± 0.65 minutes respectively, which is attributed to fact that the genital organs could be immediately accessed in flank method as compared to ventral midline. However, Reece *et al.* [13] recorded 11 minute 4 second duration for performing right flank laparotomy. In the present study, Group II showed non significantly lowest mean surgical operative procedure time as compared to Group I and Group III. This might be attributed to the length of surgical incision which was less in right flank laparotomy approach as compared to left flank and ventral midline approach. Similarly, Acharya *et al.* [1] reported less operation time in keyhole right flank laparotomy (26.2 ± 0.76 minute) as compared to ventral midline approach (49.4 ± 0.59 minute). Arunkumar *et al.* [2] also reported mean surgical time of 55.83 minute and 56.0 right flank and conventional ventral midline surgical approach respectively.

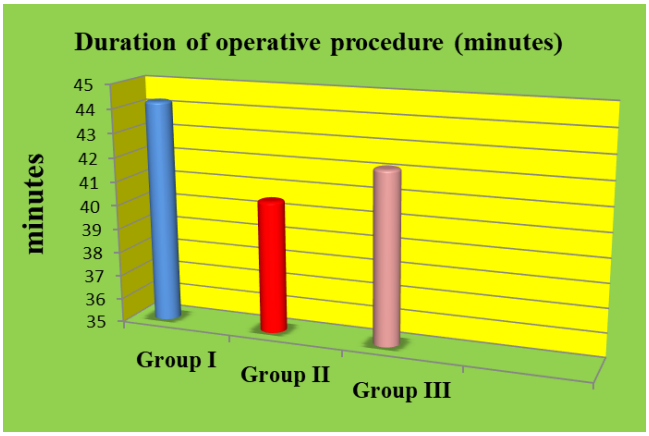

Fig 8: Mean value of duration of operative procedure (minutes) in different treatment groups

f. Cost of surgery

The cost of surgery was calculated on the basis of suture material required. The values (Mean ± SE) regarding length of suture materials (cm) for suturing in animals of different treatment groups are represented in Fig. 9. The mean length of catgut (cm) for Group I, Group II and Group III were recorded as 24.17 ± 0.48, 25.08 ± 0.24 and 25.17 ± 0.28 respectively. The mean length of petcryl (cm) for Group I, Group II and Group III were recorded as 24.5 ± 1.96, 29.3 ± 2.65, 30.70 ± 2.10 respectively. The mean length of silk (cm) for Group I, Group II and Group III were recorded 57.17 ± 4.58, 34.18 ± 3.09, 35.47 ± 2.40 respectively. Non significant difference was observed in length of catgut and petcryl in all the three Groups whereas length of silk was significantly (p<0.05) higher in Group I. Therefore, in the present study clearly records that right flank approach requires minimum suturing material as compared to ventral midline approach.

The values (Mean ± SE) of cost of surgery (Rupees) in animals of different treatment groups are shown in Table 2. The cost of surgery was significantly (P<0.05) higher in ventral midline as compare to both flank laparotomy approaches. The cost of surgery was Rs. 585.5 ± 4.10, Rs.540.38 ± 3.68 and 553.74 ±6.35 in Group I, Group II and Group III respectively. In the present study, cost of surgery was less in Group II as compared to Group I and Group III. Minimum cost of surgery in Group II (Right flank) could be

attributed to less suture material required to close the incision as compared to ventral abdominal midline laparotomy (Group I). Similarly, Murthy *et al.* [10] also reported mean surgical cost (rupees) for ventral midline approach and flank approach as 368.3 ± 4.94 and 305.8 ± 5.97 respectively.

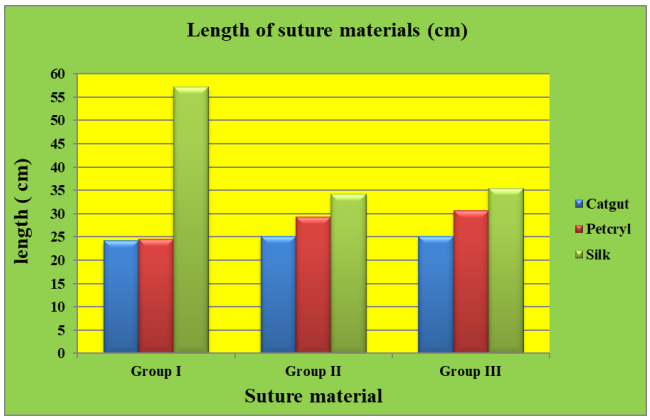

Fig 9: Mean value of length of suture materials (cm) in animals of different treatment groups

Table 2: Showing values (Mean ± SE) of cost of surgery (Rupees) in animals of various treatment groups

Parameters	Groups	Mean ± SE
Cost of Surgery (Rupees)	Group I	585.5 ^{B} ± 4.10
	Group II	540.38 ^{A} ± 3.68
	Group III	553.74 ^{A} ± 6.35

* Superscript ABC indicates significant (p<0.05) value among different groups.

g. Wound appearance at operative site

Wound appearance at operative site like swelling, discharge, dehiscence and herniation/evisceration in animals of different treatment groups at different time interval are depicted in Table 3. On 3rd day, wound at operative site showed swelling in three animals of Group I and Group II whereas in two animals of Group II. Discharge from the operative site was present in two animals in Group I and II and three animals in Group III. On 7th day post operatively, discharge from operative site was seen in three animals of Group I and one animal of Group III whereas no discharge was observed in Group II. Wound dehiscence occurred in two animals and herniation/evisceration occurred in only in one animal of Group I. On 12th day postoperatively, discharge was seen in two animals of Group I and one animal of Group III. In present study, complications like discharge, dehiscence and herniation/evisceration was observed more in Group I as compared to Group II and Group III. In contrast to present study, Coe *et al.* [3] reported that discharge from the wound was significantly more following a flank approach and documented that higher incidence of a discharge may be due to greater thickness of fat and muscle incised during this approach. Similarly, Murthy *et al.* [10] reported 3 out of 6 dogs in flank approach (50%) revealed a serosanguinous discharge upto 24-96 hour after surgery. In the present study, there were no complications in group II as compared to Group I and Group III. This might be due to overlapping arrangement of oblique muscles in flank helps to maintain intergrity of the body wall. Arunkumar *et al.* [2] reported that right lateral flank apptroach for ovariohysterectomy reduced potential for evisceration if wound dehiscence occurs. Evisceration of abdominal organs or other catastrophic consequences due to breakdown of the body wall closure are less likely to occur with the flank approach because gravitational forces exerted on a flank incision are less than those exerted on a ventral midline incision. In addition, lateral flank incision allows visual assessment of the wound without handling the animal, which would not be possible with a ventral midline incision [9].

Table 3: Wound appearance at site of operation (swelling, discharge, dehiscence and herniation/evisceration) in animals of different groups at various time intervals

Post operative days	Groups	No. of Animals	Wound appearance observed in number of animals			
			Swelling	Discharge	Dehiscence	Herniation/ evisceration
3rd day	Group I	6	3	2	0	0
	Group II	6	2	2	0	0
	Group III	6	3	3	0	0
7th day	Group I	6	0	3	2	1
	Group II	6	0	0	0	0
	Group III	6	0	1	0	0
12th day	Group I	6	0	2	0	0
	Group II	6	0	0	0	0
	Group III	6	0	1	0	0

h. Duration of wound healing

The mean value of duration of wound healing (days) was 14.17 ± 1.38, 10.17 ± 0.31 and 11.67 ± 0.56 in Group I, Group II and Group III, respectively are represented in fig 10. In the present study, minimum duration of healing was recorded in group II. Duration of healing was significantly (p<0.05) higher in Group I as compared to Group II and Group III. However, duration of healing was recorded non significantly higher in Group III as compared to Group II. Similarly, Devi *et al.* [5] observed faster wound healing in flank incision which might be due to less tension on suture line and good vascular supply. On the contrary, the midline incision frequently undergoes friction with the floor, while the animal takes rest in sternal recumbency and also impairment of wound healing in ventral midline incision due to inadequate blood supply in the linea alba.

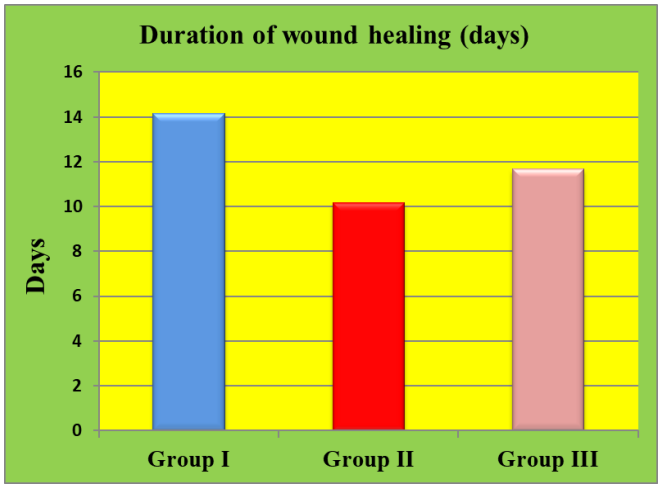

Fig 10: Duration of wound healing (days) in animals of different treatment groups

Conclusion

On the basis of the observations and evaluation made during the present study, it is concluded that ovariohysterectomy through right flank laparotomy approach is superior to other two approaches due to less duration of surgery, less suture material required, faster wound healing and minimum post operative complications. Therefore, Right flank approach is good alternative for ovariohysterectomy in bitches as compared to left flank and ventral abdominal midline approach.

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