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Comparison of right flank and ventral midline approach for ovariohysterectomy in dogs

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Abstract
The present study was conducted from octomber-2014 to octomber-2016 in twelve intact female dogs presented for elective ovariohysterectomy at the Department of Surgery and Radiology, Veterinary College, Bidar. Animals were randomly divided into two groups six in each group. Group-I animals underwent right flank ovariohysterectony and Group-II animals underwent conventional ventral midline ovariohysterectomy. Surgical techniques evaluated for clinico-physiological and haematobiochemical parameters. Surgical duration was almost same for the both approaches of ovariohysterectomy. Physiological parameters like rectal temperature and heart rate showed no significant variation in all the animals. Respiratory rate decreased significantly in all the animals, which was transitory in nature. Haematological and Biochemical parameters observations revealed that slight changes were observed in both the groups. In group-II, two dogs showed wound dehiscence whereas, in group-I animals showed uneventful recovery. Lateral flank approach for ovariohysterectomy reduced potential for evisceration if wound dehiscence occurs. Hence right flank approach is an alternative to the conventional mid-ventral approach for ovariohysterectomy in dogs.

Keywords: Ovariohysterectomy, Ventral midline, Right flank, Dogs

1. Introduction
Stray dog overpopulation and control of its menace to human beings and domestic animals is a matter of socio-economic importance in developing countries like India. The relationship between a community and its dogs is not always entirely positive as stray dogs cause road accidents, barking and fighting, biting the children, killing the livestock and uncontrolled faecal contamination [35]. Surgical sterilization of dogs and cats is one of the most commonly performed procedures in veterinary practice [1, 26, 5, 6, 27, 39]. It is done as a method of contraception to prevent the uncontrolled breeding, as well as to prevent and treat diseases associated with the reproductive system, such as mammary neoplasia, benign prostatic hyperplasia, alleviation of the risk of pyometra, and oestrus attraction of male dogs resulting inconvenience to the owner [8, 17]. An efficient anaesthetic protocol is mandatory in any surgery to prevent pain, to provide immobility and muscle relaxation without jeopardizing the life and safety of the animal [23]. Hence, atropine sulphate, xylazine, propofol and isoflurane combination was used. Whenever there is a necessary to perform an ovariohysterectomy 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. In addition, using the lateral flank approach in lactating animals minimizes disruption to the mammary glands so that animals are more likely to continue nursing appropriately after surgery.
The study was carried out at the Department of Surgery and Radiology, Veterinary College, Bidar with the following objectives:
1. To compare mid-ventral and right flank approaches for ovariohysterectomy in dogs.
2. To study and compare the effect of two approaches on stress related clinic-physiological, haematological and biochemical parameters.

2. Materials and Methods
The present study was conducted from octomber-2014 to octomber-2016 in twelve intact female dogs presented for elective ovariohysterectomy at the Department of Surgery and Radiology, Veterinary College, Bidar. Anaesthetic regimen of atropine sulphate (0.045 mg/kg,

I/M), xylazine hydrochloride (1 .mg/kg I/V), propofol (3 mg/kg I/V for induction) and isoflurane (1-2% for maintenance) was given to all the animals of both groups.

A. Surgical Anatomy

The female reproductive organs include the two ovaries, oviduct, uterus, vagina, vulva and mammary glands. The ovaries are located within a thin-walled peritoneal sac; the ovarian bursa is located just caudal to the pole of each kidney. The uterine tube courses through the wall of the ovarian bursa. Right ovary lies slight cranially than the left one. The right ovary lies dorsal to the descending duodenum and the left ovary lies dorsal to the descending colon and lateral to the spleen. Each ovary is attached by proper ligament to uterine horn and via suspensory ligament to the transversalis fascia, medial to last one or two ribs. The ovarian pedicle (mesovarium) includes the suspensory ligament with ovarian artery and vein, variable amounts of fat and connective tissue which obliterate the visualization of vasculature. The broad ligament (mesometrium) is the peritoneal fold that suspends the uterus. The round ligament travels in the free edge of the broad ligament from the ovary through the inguinal canal with the vaginal process. The uterus has a short body and long narrow horns. The uterine arteries and veins supply blood to the uterus. Cervix is the constricted caudal part of uterus and is thicker than the uterine body and vagina. It is oriented in a nearly vertical position with the uterine opening dorsally. or right side laparotomy, the abdominal muscles *viz*., *obliques abdominis externus, obliqeus abdominis internus and transeversarius abdominis* muscles come across from outside to inside.

B. Procedure: Right flank ovariohysterectomy

The animal was taken to left lateral recumbency after anaesthesia. Surgical field hairs clipped and site was prepared using (4%) chlorhexidine gluconate and (70%) isopropyl alcohol. Right flank was draped. Two to three finger width from last rib and ventral to the transverse processes of lumbar vertebrae, at that angular junction, an oblique incision of 2.5-3.0 cm was made in downward and backward direction. The abdominal muscles were separated layer by layer to reach the abdominal cavity. The right uterine horn was grasped with finger or Addison forceps. Triple clamping was done to ovarian pedicle. Transfixation ligature was done on pedicle at the lowest and distant clamp using chromic catgut No.2 for all the animals. Ovarian pedicle was severed between the clamp closure to the ovary and the middle one. The pedicle was carefully observed for bleeding and then gently dropped into abdomen. The procedure was repeated for the left 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.2 in the groove. The pedicle was inspected for bleeding after removing the clamps. The pedicle was gently replaced in to the abdomen after the haemostat was removed. The genitalia were taken out with the clamps attached to three ends.

C. Closure of the abdominal cavity

A common suturing pattern was followed for all the animals of group-I. The peritoneum and the *transverse abdominis* muscle were sutured together in simple continuous pattern, *obliques abdominis externus* and *obliques abdominis internus* were sutured together by simple interrupted pattern. Skin was sutured using nylon No. 0 (monofilament polyamide) by mattress pattern.

D. Procedure: Midventral ovariohysterectomy

The animals of group-I was taken on dorsal recumbency after anaesthesia. Surgical site was prepared as per the standard procedure. Caudal midventral area was draped. The skin and linea alba were incised layer by layer to reach the abdominal cavity. Further same procedure followed as of that right flank ovariohysterctomy.

Clinical and physiological parameters recorded before pre-operative, during operation and post-operative (at 120 minutes after induction of anaesthesia).

The hematobiochemical observations *viz*., haemoglobin (g/dL), total leukocyte count (x10^3 /µL), total erythrocyte count (x10^6 /µL), Packed Cell Volume (%) and differential leukocyte count (%) [4, 19, 42], Biochemical observations *viz*., AST, ALT, serum urea nitrogen and serum creatinine were estimated before pre-operative, during operation and post-operative (at 120 minutes after induction of anaesthesia), these parameters were estimated by using ARTOS* biochemical analyzer using respective diagnostic kit.

E. Statistical analysis

The mean and standard error of all parameters were computed as per Snedecor and Cochran (1994). The variations in different parameters were recorded at different time intervals within the animals and were analyzed using student "t" test as described [38].

3. Results and Discussion

The present study was conducted on twelve clinical cases of dogs brought for elective

*****ARTOS® Biochemical analyser and kits, M/s Swemed diagnostics, Bengaluru, India.

ovariohysterectomy at Department of Surgery and Radiology, Veterinary College, Bidar. The surgical methods *viz*., right flank ovariohysterectomy and midventral ovariohysterectomy were compared. The anaesthetic regimen comprising of atropine sulphate, xylazine hydrochloride and propofol for induction and isoflurane for maintenance was standardized. The results of this study are discussed under the following headings.

A. Selection, Preparation and Positioning of the animals

The Mean±SE body weight and the age of all the dogs selected for this study were 16.92±2.54 kg and 43.00±5.00 months respectively. The dogs of weight and age group that ranged between 10-17 kg and 12-72 months respectively selected for conventional method of ovariohysterectomy [32, 33, 36]. McGrath *et al.* [28] advocated 6-7 months and less than 12 weeks respectively for flank approach of ovariohysterectomy. The animals were kept on 12 hours of off feeding and 6 hours of off water. In group-I animals left lateral recumbency with limbs stretched and secured loosely to expose the flank area of animals was also followed and approved by Miller *et al.* [29] for flank method of ovariohysterectomy. In group-II animals on dorsal recumbency with limb stretched and secured loosely to expose the midventral area.

B. Clinical Observations

i. Surgical procedure

In group-I dogs, the surgical site selection on right flank, the oblique downward and backward incision of 2.5-3.5cm facilitated the direct approach to the right ovary and similar opinion was quoted by Vandana [40]. In group-II dogs surgical

site selection on caudal midventral direct approach to the body of uterus and horns. There were no incidents of wound dehiscence, self-mutilation or evisceration in any of the animals of group-I. whereas, in group-II animals these complications were observed. Dorn [11], Krzaczynski [22] and Levy [24] also mentioned similar advantages with flank approach. The right flank approach, however, McGrath *et al.* [28] mentioned that flank approach should be avoided in dogs with wide body conformation or thick trunk musculature. Advantages of the lateral flank approach for ovariohysterectomy include the ability to observe the surgical wound from a distance and reduced potential for evisceration if wound dehiscence occurs. These advantages are especially important when managing the stray animal populations. The opportunity to examine these animals after surgery is often very limited therefore, it is often necessary to monitor them from a distance. A lateral flank incision allows visual assessment of the wound without handling the animal, which would not be possible with a ventral midline incision. 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. Also, the overlapping arrangement of the oblique muscles in the flank helps maintain integrity of the body wall if wound complications occur. Another advantage of the flank approach is the efficiency with which an ovariohysterectomy can be performed once a surgeon becomes comfortable with the approach. With a flank incision, the ipsilateral ovary and uterine horn lie immediately below the incision, making them very easy to locate. This eliminates some of the time normally required to locate an ovary using the ventral midline approach, thereby minimizing surgical time.

ii. Surgical duration (Minutes)

The mean surgical time recorded in the present study was 55.83 in group-I and 56 minutes in group-II. Davidson *et al.* [8], Devitt *et al.* [10], Vandana [40] and Pukacz *et al.* [33] reported 69, 18, 50 and 59 minutes respectively for conventional ovariohysterectomy either by flank or by mid ventral method. However, Murthy *et al.* [32] and Reece *et al.* [36] reported 7.16 and 11 minute and 4 seconds respectively for the same under shelter setting.

iii. Haemostasis

The ovarian pedicles and both uterine arteries were ligated by transfixation method using chromic catgut No. 2 which provided complete haemostsis in all the animals of both the groups Fingland [13], Fossum and Hedlund [14] and Bencharif *et al.* [3] explained similar method of haemostasis in conventional method of ovariohysterectomy.

C. Physiological observations

i. Rectal Temperature (°F)

Rectal temperature decreased slightly in all the animals of both the groups and returned to near baseline on post-operative. This observation could be due to xylazine-propofol anaesthesia. Lu *et al.* [25] attributed that to administration of xylazine, decrease in metabolic rate, muscle relaxation and central nervous system depression. However, Holey [15] and Vishwanatha [41] and Ravikumar [34] found no significant post-operative change in the rectal temperature during their studies.

ii. Respiratory Rate (Breaths/min)

Respiratory rate showed a significant decrease in during operation and postoperative period when compared to pre-operative period in all the animals of both the groups. The initial fall in the respiratory rate could be attributed to combined effects of anaesthesia, intra-operative blood loss. Hossain and Karmakar [16] and Shirodkar *et al.* [37] recorded a fall in the respiratory rate due to intra-operative bleeding, anaesthetic effect, pre-operative fasting. All the animals showed an episode of transient apnoea for 5-10 seconds immediately after propofol induction. Similar findings were reported by Morgan and Legge [31].

iii. Heart Rate (Beats/min)

The variations in the heart rates were within normal physiological limits in all the animals of both the groups throughout the observations. In all the animals non significant increase in heart rate observed throughout the study period. However, bradycardia induced by xylazine was prevented by prior administration of atropine [18, 20]. Atropine increases heart rate by an early central stimulation of the vagal centre followed by a peripheral blocking action.

D. Haematological parameters

i. Total Erythrocyte Count ($x10^6$/µl)

The erythrocyte levels fluctuated within normal physiological range at all the intervals of study in all the animals of both the groups. Holey [15], Vishwanatha [41] and Ravikumar [34] reported similar non-significant red blood cell level variations in their studies. However, Fani *et al.* [12] recorded significant decrease in erythrocyte count after xylazine medication.

ii. Haemoglobin (g/dl)

There was significant decrease in haemoglobin levels at during operation and post-operative in all the animals of both the groups. The fall in the haemoglobin levels immediately after surgery could be attributed to pre-operative fasting, anaesthesia, intra-operative bleeding, and surgical stress. The findings are in accordance with those of Hossain and Karmarkar [16] and Fani *et al.* [12].

iii. Packed Cell Volume

The changes in the packed cell volume were within the normal physiological range and the variations were statistically and clinically non-significant decreased at all the intervals of study in both the groups of animals.

iv. Total Leucocyte Count ($X10^3$)

The total leucocyte count non-significantly decreased at post-operative period from pre-operative period in all the animals of both the groups. This observation was typical to post-surgical stress leucogram. Fani *et al.* [12] recorded a decrease in the leucocyte level after xylazine administration. However, Holey [15], Ravikumar [34] and Vishwanatha [41] reported non-significant fluctuations in their studies.

v. Differential Leucocyte Count

There was neutrophilia with relative compensatory lymphocytopaenia in the immediate post-operative period in all the animals of both the groups. The changes in neutrophil count might be indicative of comparatively more surgical stress. The other components of differential leucocyte count *viz.*, monocytes and eosinophils fluctuated in the normal physiological range without significant variation in all the animals. Millis *et al.* (1992) and Bodanariu (2008) observed neutrophilia, lymphocytopaenia and eosinopaenia in ovariohysterectomized dogs. However, Holey [15] and Vishwanatha [41] did not find significant changes in differential leucocyte count in conventional surgery.

E. Biochemical parameters

Alanine transaminase levels were in normal physiological limits in all the animals of both the groups during all the intervals of study. Aspartate transaminase levels were also in the normal range. Holey [15] and Ravikumar [34] also reported no significant change in transaminase values in their studies involving conventional surgeries. Krausaz *et al*. [21] and Deswal and Chohan [9] reported increased transaminase levels after surgery and attributed that to an increased metabolic demands and gluconeogenesis after surgery. The serum urea and nitrogen levels slightly increased during the study period, which were within the normal physiological limit. Fani *et al.* [12] also reported an increase in the levels after xylazine medication. The serum creatinine levels were rose up in post-operative period that was non-significant. Nevertheless serum urea nitrogen and creatinine levels were in normal range throughout study. Holey [15], Vishwanatha [41] and Ravikumar [34] also reported non-significant changes during their conventional surgeries.

4. Conclusion

Compare to conventional mid-ventral approach, right flank incision allows visual assessment of the wound without handling the animal, which would not be possible with a ventral midline incision. 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. Also, the overlapping arrangement of the oblique muscles in the flank helps maintain integrity of the body wall if wound complications occur. Another advantage of the flank approach is the efficiency with which an ovariohysterectomy can be performed once a surgeon becomes comfortable with the approach with a flank incision, the ipsilateral ovary and uterine horn lie immediately below the incision, making them very easy to locate. This eliminates some of the time normally required to locate an ovary using the ventral midline approach, thereby minimizing surgical time.

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Table 1: Mean±SE of physiological parameters at different intervals in all the dogs.

S. No	Parameter	Group	Pre-operative	During operation	Post-operative
1	Rectal Temperature (^{0}F)	Group-I	101.97±0.37	101.58±0.55	101.15±0.61
		Group-II	101.87±0.12	101.05±0.75	100.52±0.75
2	Respiratory Rate (Breaths/min)	Group-I	55.67±10.39	16.50±3.24**	29.83±4.01*
		Group-II	49.00±9.23	12.17±2.36**	28.00±5.42
3	Heart Rate (Beats/min)	Group-I	85.50±9.00	108.50±14.66	106.00±12.21
		Group-II	92.67±2.63	81.83±4.42	91.00±3.89

Values bearing superscript*differ significantly (P≤0.05) from interval 'before' within the group.
Values bearing superscript**differ significantly (P≤0.01) from interval 'before' within the group.

Table 2: Mean±SE of Haematological parameters at different intervals in dogs.

Parameter	Group	Pre-operetive	During operation	Post-operative
TEC (x10^6 /µL)	Group-I	6.23±0.13	5.90±0.12	5.85±0.14
	Group-II	6.63±0.25	5.98±0.19	6.00±0.19
Hb (g/dL)	Group-I	12.42±0.49^a	10.30±0.16**	9.93±0.07**
	Group-II	11.08±0.22^b	10.83±0.26	9.82±0.14**
Packed Cell Volume (%)	Group-I	32.00±0.92	31.22±0.88	30.50±0.76
	Group-II	33.83±0.31	33.00±0.37	32.67±0.71
TLC (x10^3 /µL)	Group-I	9.27±0.07	9.12±0.03	9.08±0.06
	Group-II	9.22±0.12	9.18±0.11	9.05±0.13
Neutrophils (%)	Group-I	72.50±0.67	75.00±0.52*	73.83±0.31
	Group-II	72.83±0.87	75.33±0.61*	74.17±0.70
Lymphocytes (%)	Group-I	24.83±0.70	23.17±0.48	24.17±0.40
	Group-II	24.33±0.33	22.50±0.67*	23.67±0.42
Eosinophils (%)	Group-I	1.33±0.21	1.00±0.00	1.00±0.00
	Group-II	1.67±0.21	1.33±0.21	1.33±0.21
Monocytes (%)	Group-I	1.33±0.21	0.83±0.17	1.00±0.00
	Group-II	1.17±0.17	0.83±0.17	0.83±0.17

Values bearing superscript*differ significantly at P≤0.05 from interval "before" within the group.
Values bearing superscript**differ significantly at P≤0.01 from interval "before" within the group.
Values bearing superscript **a,b,** differ significantly (P≤0.05) level between groups at corresponding intervals
Basophil count in both groups at all the intervals was "0"

Table 3: Mean±SE of Biochemical parameters at different intervals in dogs.

Parameter	Group	Pre-operative	During operation	Post-operative
Alanine Transaminase (IU/L)	Group-I	29.83±0.40	30.17±0.31	31.17±0.54
	Group-II	30.83±0.60	31.33±0.49	32.33±0.42
Aspartate Transaminase (IU/L)	Group-I	30.83±0.48	31.50±0.56	32.17±0.48
	Group-II	29.33±0.95	29.67±0.88	30.33±0.99
Serum Urea Nitrogen (mg/dL)	Group-I	18.33±0.42	18.50±0.50	18.67±0.61
	Group-II	18.00±0.52	18.67±0.33	19.17±0.48
Creatinine (mg/dL)	Group-I	1.30±0.04	1.40±0.04	1.45±0.06
	Group-II	1.29±0.03	1.38±0.03	1.40±0.04

a. Pre-operative preparation of dog

b. Skin incision on lateral flank

c. Exteriorization of uterine horn

d. Skin closure with prolene suture

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