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Effect of laparoscopic and right flank approaches of on haematological and biochemical parameters in dogs

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Abstract

The study was conducted in twelve healthy sexually intact female dogs presented for elective birth control surgery at the Department of Surgery and Radiology, Veterinary College Bidar. The animals were randomly divided into two groups viz., Group-I and Group-II, each consisting of six dogs. The animals were kept on 24 hours of off feeding and 12 hours of off water. Bladder catheterization was done for both the groups of animals. The erythrocyte levels fluctuated within normal physiological range at all the intervals of study in both the groups of animals. The erythrocyte levels, packed cell volume fluctuated within normal physiological range at all the intervals of study in both the groups of animals. There was decrease in haemoglobin levels from pre-operative to soon after surgery and the values rose up to near baseline on 10th post-operative day in both the groups of animals. The rise on 10th day was significant in Group-I animals. The total leucocyte count significantly increased at immediate post-operative period from pre-operative period in both the groups and returned to base level on 10th day after surgery. The total leucocyte count significantly increased at immediate post-operative period from pre-operative period in both the groups and returned to base level on 10th day after surgery. The neutrophil-lymphocyte ratio was increased at immediate post-operative period and was significant only in Group-II animals. Alanine transaminase and aspartate transaminase levels were also in the normal range without significance. The blood urea nitrogen levels in Group-I and II increased in post-operative periods and 10th day. The changes were significant only in Group-I animals indicative of comparatively higher renal stress in them than in Group-II animals in addition to anaesthetic stress.

Keywords: Laparoscopy, ovariohysterectomy, haematology, biochemical

Introduction

Stray dog over population and control of its menace to human beings and domestic animals is a matter of socio- economic importance in developing countries like India. Surgical sterilization of dogs and cats is one of the most commonly performed procedures in veterinary practice [1]. Over the years, many number of neutering surgical techniques have been tried, updated and lot of advancements have been achieved to minimize the surgical morbidity of the ovariectomy animal. Lateral flank (both sides), mid ventral and laparoscopic approaches for both and ovariohysterectomy have been studied for their advantages and disadvantages [2]. Laparoscopic surgery has largely been developed in equine medicine rather than in small animals [3] and being vastly employed in observation, biopsy of the abdominal organs, and evaluation of colic cases, hernia repair, reproductive surgery, and urological and digestive surgery [4].

Keeping view of mass sterilization in dogs, two surgical procedures of neutering female dogs, viz., right flank ovariohysterectomy and laparoscopic method of ovariohysterectomy were followed and effect on hematological and biochemical parameters were studied here.

Materials and methods

The study was conducted in twelve healthy sexually intact female dogs presented for elective birth control surgery at the Department of Surgery and Radiology, Veterinary College Bidar. The animals were randomly divided into two groups viz., Group-I (Right flank Ovariohysterectomy) and Group-II (Laparoscopic Ovariohysterectomy), each consisting of six dogs.

Only physiologically fit individuals were selected for the study. Pre-anesthetics used were: Atropine sulphate @ 0.045mg/kg I/M and Xylazine HCl @ 1mg/kg I/M. General anesthesia protocol followed was:

Propofol @ 4mg/kg body weight I/V for induction and maintenance @ 0.4 mg/kg/min.

The Mean ±SE body weight of dogs selected for Group-I and Group-II were 16.92±2.54 kg and 11.58±1.15 kg respectively. The average age of Group-I and Group-II animals was 43.00±5.00 months and 42.17±6.87 months respectively.

The dogs of both the groups were kept off fed for 24 hours and off watered for 12 hours before surgery. Ceftriaxone Sodium was administered to all the animals at the dose rate of 20 mg/kg body weight I/V, two hours prior to the operation. Heart rate, respiratory rate and rectal temperature were recorded on the day of surgery to rule out any abnormality. Urinary bladder was emptied by catheterization just prior to induction of anesthesia in both the groups of animals. Warm soap water enema was administered two hours before the surgery for Group-II animals. For Group-I dogs, right flank area and for Group-II, ventral abdomen (xiphoid to os pubis) including paramedian area were aseptically prepared as per standard procedure.

The general surgical instruments were sterilized by autoclaving at 121 °C, 15 lbs psi for 15 minutes. The laparoscopic instruments were wiped with 10 % ethyl alcohol and kept in a closed chamber with formalin tablets. Just before surgery, the instruments were rinsed in distilled water to remove formalin remnant and wiped with sterile mops.

Haematological parameters

Two ml blood was collected in EDTA coated vials using disposable syringes through cephalic or recurrent tarsal vein in all the cases. The collection was preoperatively, post-operatively (soon after surgery) and on 10th day after surgery for all the cases.

Total Erythrocyte Count (10⁶ /µl)

Total erythrocyte count was estimated as per the procedure described by Weiss and Wardrop (2010) using Neubauer's slide and the values were expressed as million cells per micro litre of blood (10⁶/µl).

Haemoglobin (g/dl)

Haemoglobin was estimated by Shali's haemoglobinometer as per the standard method recommended [5] and the values were expressed in g/dl.

Packed Cell Volume (%)

Packed cell volume was estimated by microhematocrit method as per the procedure recommended [6] and the values were expressed as percentage.

Total Leucocyte Count (10³ / µl)

Total leucocyte count was estimated as per the procedure described by Jain (1993) and the values were expressed as thousand cells per micro liter of blood (10³/µl).

Differential Leucocyte Count

Blood smears for differential leucocyte count were stained with Giemsa stain and cells were counted using Battlement method as described [7] and the individual cells were expressed in percentage.

Neutrophil-lymphocyte ratio

The ratio between neutrophil and lymphocyte counts was estimated for all the animals as an indicator of stress factor [8].

Biochemical parameters

Blood samples were collected in clot activator vials to separate the serum. The collection was done pre-operatively, post-operatively (soon after surgery) and on 10th day after surgery for estimation of aspartate aminotransferase (IU/L), alanine aminotransferase (IU/L), serum creatinine (mg/dl) and serum urea nitrogen (mg/dl). These parameters were estimated by using ARTOS biochemical analyzer using respective diagnostic kit.

Statistical analysis

The haemato-biochemical data obtained during the study were tabulated, graphically represented and subjected to statistical analysis using Student 't' test as per standard procedure [9].

Results and discussion

Haematological parameters

Total Erythrocyte Count (x10⁶ /µl)

The total erythrocyte count (Mean ±SE) in Group-I animals pre-operative, postoperatively (soon after surgery) and on 10th day after surgery were; 9.33±1.51, 9.37±0.71 and 11.72±0.97 respectively. The total erythrocyte count (Mean ±SE) for Group-II animals were; 11.25±1.07, 9.53±0.75 and 12.67±1.25 respectively for the corresponding intervals (Table 1).

Table 1: Mean ±SE values of TEC, Hb, PCV and TLC at different intervals in both the groups

Parameter/s	Group	Pre-operative	Post-operative	10 th day after surgery
Total Erythrocyte Count (x10 ⁶ /µl)	Group-I	9.33±1.51	9.37±0.71	11.72±0.97
	Group-II	11.25±1.07	9.53±0.75	12.67±1.25
Haemoglobin (g/dl)	Group-I	9.92±1.11	9.08±0.33 ^c	10.42±0.49 ^d
	Group-II	10.50±0.34	9.92±0.51	10.67±0.49
Packed Cell Volume (%)	Group-I	41.28±1.58	38.67±1.12	39.83±0.83
	Group-II	40.17±0.87	39.17±1.14	40.33±1.02
Total Leucocyte Count (x1000/µl)	Group-I	12.02±7.58	14.95±7.62 ^c	11.77±6.80 ^d
	Group-II	11.22±9.90	14.70±12.05 [*]	13.13±4.54

Means bearing * superscript differ significantly (P≤0.05) from pre-operative values within the group. Means bearing c, d superscript differ significantly (P≤0.05) from post-operative values to 10th day after surgery within the Group-I

Haemoglobin (g/dl)

The haemoglobin (Mean ±SE) in Group-I animals pre-operatively, postoperatively (soon after surgery) and on 10th day after surgery were; 9.92±1.11, 9.08±0.33 and 10.42±0.49 respectively. The (Mean ±SE) haemoglobin values in Group-II animals for the corresponding intervals were; 10.50±0.34,

9.92±0.51 and 10.67±0.49 respectively. Haemoglobin level was decreased (p>0.05) on post-operative day and was increased on 10th post-operative day in both the groups when compared to pre-operative period. The changes were statistically non-significant. However, the haemoglobin levels in Group-I animals was significantly (p≤0.05) higher on 10th

day compared to postoperative day (Table 1). The comparison between two groups depicted that there was no statistical difference ($p>0.05$) in the haemoglobin levels at any corresponding intervals. The fall in the haemoglobin levels immediately after surgery could be attributed to pre-operative fasting, anesthesia, intra-operative bleeding, surgical stress and abdominal inflation. The findings were in accordance with those of earlier studies [13].

Packed Cell Volume (%)

The packed cell volume (Mean \pm SE) in Group-I animals pre-operatively, postoperatively (soon after surgery) and on 10th day after surgery were; 41.28 \pm 1.58, 38.67 \pm 1.12 and 39.83 \pm 0.83 respectively. The packed cell volume (Mean \pm SE) values in Group-II animals for the corresponding intervals were; 40.17 \pm 0.87, 39.17 \pm 1.14 and 40.33 \pm 1.02 respectively. The packed cell volume was decreased after surgery in both the groups and reached near normal on 10th post-operative day in both the groups. The changes were statistically non-significant ($p>0.05$). The comparison between two groups revealed that there was no statistically significant ($p>0.05$) difference in packed cell volume at any corresponding intervals. A recent study found non-significant variation in the packed cell volume after laparoscopic ovariectomy [12] (Table 1).

Total Leucocyte Count ($\times 10^3/\mu\text{l}$)

The total leucocyte count (Mean \pm SE) in Group-I animals pre-operatively, postoperative (soon after surgery) and on 10th day after surgery were; 12.02 \pm 7.58 14.95 \pm 7.62 and 11.77 \pm 6.80 respectively. The total leucocyte count (Mean \pm SE) values in Group-II animals for the corresponding

intervals were; 11.22 \pm 9.90, 14.70 \pm 12.05 and 13.13 \pm 4.54 respectively. The comparison within groups revealed that there was a statistically significant ($p\leq 0.05$) increase in the total leucocyte count in post-operative from pre-operative period. The value returned to near baseline with statistical significance ($p\leq 0.05$) from postoperative to 10th day after surgery in Group-I animals. The comparison between groups for total leucocyte count depicted that there was no statistically significant difference ($p>0.05$) in the values at any corresponding intervals. Earlier reports mentioned similar observation [14]. However, some reported non-significant fluctuations in their studies [10, 11]. The increase in the leucocyte count could be attributed to sequestration of marginal pool of leucocytes into general circulation (Table 1).

Differential Leucocyte Count: Neutrophil (%)

The neutrophil count (Mean \pm SE) in Group-I animals pre-operatively, postoperatively (soon after surgery) and on 10th day after surgery were; 64.17 \pm 3.27, 72.33 \pm 2.56 and 68.50 \pm 2.39 respectively. The neutrophil count (Mean \pm SE) values in Group-II animals for the corresponding intervals were; 65.00 \pm 1.67, 70.33 \pm 1.05 and 63.67 \pm 1.52 respectively. The neutrophil count was increased post-operatively when compared to preoperative period in both the groups of animals. The neutrophil count decreased to near normal on 10th post-operative day in both the groups. The changes were statistically significant ($p\leq 0.05$) only in Group-I. The comparison between two groups revealed that there was no statistically significant difference in neutrophil count ($p>0.05$) at any corresponding intervals (Table 2).

Table 2: Mean \pm SE values of Differential Leukocyte Count at different intervals of time in both the groups of animals

Parameter	Time interval	Group-I	Group-II
Neutrophil (%)	Pre-operative	64.17 \pm 3.27	65.00 \pm 1.67
	Post-operative	72.33 \pm 2.56	70.33 \pm 1.05 ^{*x}
	10 th day after surgery	68.50 \pm 2.39	63.67 \pm 1.52 ^y
Lymphocyte (%)	Pre-operative	30.00 \pm 3.47	33.00 \pm 1.69
	Post-operative	23.67 \pm 2.43	25.50 \pm 1.12 ^{*x}
	10 th day after surgery	28.33 \pm 2.35	34.17 \pm 1.56 ^y
Monocyte (%)	Pre-operative	1.50 \pm 0.22	1.67 \pm 0.17
	Post-operative	1.67 \pm 0.17	1.33 \pm 0.21
	10 th day after surgery	1.83 \pm 0.31	1.83 \pm 0.17
Eosinophil (%)	Pre-operative	2.17 \pm 0.31	0.83 \pm 0.17
	Post-operative	1.33 \pm 0.21	1.33 \pm 0.21
	10 th day after surgery	1.33 \pm 0.21	1.33 \pm 0.21
Basophil (%)	Pre-operative	0.00 \pm 0.00	0.00 \pm 0.00
	Post-operative	1.50 \pm 0.22	1.50 \pm 0.22
	10 th day after surgery	0.00 \pm 0.00	0.00 \pm 0.00

Means bearing * superscript differ significantly ($P\leq 0.05$) from pre-operative values within the group. Means bearing superscript ** differ significantly ($P\leq 0.01$) from pre-operative values within the group

Means bearing superscript x, y differ significantly ($P\leq 0.01$) from post-operative values to 10th day after surgery within the group.

Means bearing a, b superscript differ significantly ($P\leq 0.05$) between the groups at corresponding intervals

Lymphocyte (%)

The lymphocyte count (Mean \pm SE) in Group-I animals pre-operatively, postoperatively (soon after surgery) and on 10th day after surgery were; 30.00 \pm 3.47, 23.67 \pm 2.43 and 28.33 \pm 2.35 respectively. The lymphocyte count (Mean \pm SE) values in Group-II animals for the corresponding intervals were; 33.00 \pm 1.69, 25.50 \pm 1.12 and 34.17 \pm 1.56 respectively. There was relative lymphocytopenia on post-operative day when compared to pre-operative day in both the groups of animals. The lymphocyte level reached near normal by 10th

day in both the groups. Lymphocytopenia of post-operative period was significant at 1% level from pre-operative level and at 5% level from 10th post-operative day in Group-II animals.

Monocyte (%)

The monocyte count (Mean \pm SE) in Group-I animals pre-operatively, postoperatively (soon after surgery) and on 10th day after surgery were; 1.50 \pm 0.22, 1.67 \pm 0.17 and 1.83 \pm 0.31 respectively. The monocyte count (Mean \pm SE) values in

Group-II animals for the corresponding intervals were; 1.67±0.17, 1.33±0.21 and 1.83±0.17 respectively.

Eosinophil (%)

The eosinophil count (Mean ±SE) in Group-I animals pre-operatively, postoperatively (soon after surgery) and on 10th day after surgery were; 2.17±0.31, 1.33±0.21 and 1.33±0.21 respectively. The eosinophil count (Mean ±SE) values in Group-II animals for the corresponding intervals were; 0.83±0.17, 1.33±0.21 and 1.33±0.21 respectively.

Basophil (%)

The basophil count (Mean ±SE) in Group-I animals pre-operatively, postoperatively (soon after surgery) and on 10th day after surgery were; 0.00±0.00, 1.50±0.22 and 0.00±0.00 respectively. The basophil count (Mean ±SE) values in Group-II animals for the corresponding intervals were; 0.00±0.00, 1.50±0.22 and 0.00±0.00 respectively. Earlier report observed neutrophilia, lymphocytopenia and eosinopaenia in ovariohysterectomized dogs [15]. However,

earlier studies did not find significant changes in differential leucocyte count either in conventional or in laparoscopic surgery [10, 12]. The changes in neutrophil count was significant in Group-I animals might be indicative of comparatively more surgical stress in that group than in Group-II animals.

Neutrophil-lymphocyte ratio

The neutrophil-lymphocyte ratio (Mean ±SE) in Group-I animals pre-operatively, post-operatively (soon after surgery) and on 10th day after surgery were; 2.35±0.38, 3.31±0.51 and 2.54±0.29 respectively. The (Mean ±SE) values in Group-II animals for the corresponding intervals were; 2.01±0.15, 2.80±0.16 and 1.89±0.14 respectively. Both the groups of animals showed increase in neutrophil-lymphocyte ratio at postoperative period. However, it was significant (p≤0.01) only in Group-II animals. Group-II animals had significantly (p≤0.01) higher neutrophil-lymphocyte ratio at post-operative period even when compared to 10th post-operative day. This was a typical postsurgical finding reported earlier [8] (Table 3).

Table 3: Mean ±SE values of Neutrophil-lymphocyte ratio at different intervals of time in both the groups of animals

Group	Neutrophil-lymphocyte ratio		
	Pre-operative	Post-operative	10 th day after surgery
Group-I	2.35±0.38	3.31±0.51	2.54±0.29
Group-II	2.01±0.15	2.80±0.16 ^{**x}	1.89±0.14 ^y

Means bearing superscript ** differ significantly (P≤0.01) from pre-operative values within the group. Means bearing superscript x, y differ significantly (P≤0.01) from post-operative values to 10th day after surgery within the Group-II animals

Alanine Transaminase (IU/L)

The alanine transaminase (Mean ±SE) values in Group-I animals pre-operatively, post-operatively (soon after surgery) and on 10th day after surgery were; 56.17±3.04, 66.67±5.26 and 62.67±2.29 respectively. The (Mean ±SE) values in Group-II animals for the corresponding intervals were; 42.50±4.60, 50.50±5.02 and 42.67±3.35 respectively. The

serum alanine transaminase level fluctuated within the normal physiological limits in both the groups. The comparison between the groups revealed that the alanine transaminase level was significantly (p≤0.05) higher in the corresponding intervals of pre-operative and the 10th day after surgery (Table 4).

Table 4: Mean ±SE values of Biochemical parameters at different intervals in both the groups

Parameter/s	Group	Pre-operative	Post-operative	10 th day after surgery
Alanine Transaminase (IU/L)	Group-I	56.17±3.04 ^a	66.67±5.26	62.67±2.29 ^a
	Group-II	42.50±4.60 ^b	50.50±5.02	42.67±3.35 ^b
Aspartate Transaminase (IU/L)	Group-I	56.50±4.22	62.00±3.35	61.00±3.61 ^a
	Group-II	50.17±6.49	54.00±2.82 ^c	43.00±4.00 ^{db}
Serum Urea Nitrogen (mg/dl)	Group-I	19.00±1.12	24.67±1.33 ^{**}	23.00±1.29 ^e
	Group-II	18.50±1.61	20.50±1.33	19.50±1.09
Serum creatinine (mg/dl)	Group-I	1.00±0.15	1.47±0.13 [*]	1.37±0.08
	Group-II	1.00±0.05	1.27±0.10	1.10±0.07

Means bearing a, b superscript differ significantly (P≤0.05) between the groups at corresponding intervals. Means bearing c, d superscript differ significantly (P≤0.05) from post-operative values within the Group-II animals. Means bearing superscript ** differ significantly (P≤0.01) from pre-operative values within the Group-I animals. Means bearing * superscript differ significantly (P≤0.05) from pre-operative values within the Group-I animals

Aspartate Transaminase (IU/L)

The aspartate transaminase (Mean ±SE) values in Group-I animals preoperatively, post-operatively (soon after surgery) and on 10th day after surgery were; 56.50±4.22, 62.00±3.35 and 61.00±3.61 respectively. The (Mean ±SE) values in Group-II animals for the corresponding intervals were; 50.17±6.49, 54.00±2.82 and 43.00±4.00 respectively. The comparison within the Group-I animals suggested that the values fluctuated in the normal range with no statistically significant difference (p>0.05). In Group -II animals, the aspartate transaminase value significantly reduced (p≤0.05) on 10th day compared to that on post-operative day. The aspartate transaminase values between the groups on

corresponding 10th day showed a statistically significant difference (p≤0.05) among them. Some studies also reported no significant change in transaminase values in their studies involving conventional and laparoscopic surgeries [10, 11] (Table 4).

Serum Urea Nitrogen (mg/dl)

The serum urea nitrogen (Mean ±SE) values in Group-I animals pre-operatively, post-operatively (soon after surgery) and on 10th day after surgery were; 19.00±1.12, 24.67±1.33 and 23.00±1.29 respectively. The (Mean ±SE) values in Group-II animals for the corresponding intervals were; 18.50±1.61, 20.50±1.33 and 19.50±1.09 respectively. There

was rise in serum urea nitrogen level post-operatively when compared to pre-operative period in both the groups. It remained higher ($p \leq 0.05$) even on 10th day in Group-I. Whereas, it returned to near normal on 10th day in Group-II animals. The comparison between two groups suggested that there was no statistically significant difference ($p > 0.05$) in serum urea nitrogen at any corresponding intervals (Table 4).

Serum Creatinine (mg/dl)

The serum creatinine (Mean \pm SE) values in Group-I animals pre-operatively, postoperatively (soon after surgery) and on 10th day after surgery were; 1.00 ± 0.15 , 1.47 ± 0.13 and 1.37 ± 0.08 respectively. Mean \pm SE values in Group-II animals for the corresponding intervals were; 1.00 ± 0.05 , 1.27 ± 0.10 and 1.10 ± 0.07 respectively. The serum creatinine level rose up on post-operative period when compared to pre-operative level in both the groups of animals. However, the rise was significant ($p \leq 0.05$) only in Group-I animals. The creatinine level returned to near normal on 10th post-operative day in both the groups of animals. There was no statistical significant difference ($p > 0.05$) in serum creatinine level between the groups at any corresponding intervals. The rise was comparatively lesser in Group-II which might be due to lesser muscular injury in laparoscopic surgery than in right flank approach. Some studies also reported non-significant changes during their comparative studies of conventional and laparoscopic surgeries^[11] (Table 4).

Conclusion

In summary, the study was conducted in twelve intact female dogs which were randomly divided into two groups viz., Group-I and Group-II each consisting of six dogs. Comparison of right flank and laparoscopic techniques for ovariohysterectomy and comparative assessment of these techniques on haematological and biochemical parameters were done in both the groups of animals. The haematological and biochemical observations were within the normal range. The variations were typical to post-surgical scenario; were clinically and statistically non-significant, meant that both the techniques did not cause any adverse effect on cardiovascular, respiratory, renal and hepatic system.

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