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Comparative Study on Midline and Flank Approaches for Ovariohystrectomy in Cats

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ABSTRACT

The study was carried out to compare midline and flank approaches for ovariohysterectomy in cats. The following parameters were studied: age, weight, incision length, duration of operation (min), duration of wound healing (days), gross wound appearance, histological characterization of wound healing and complications. Cats were divided into two groups based on surgical approaches for ovariohysterectomy Group-F (Flank approach) and Group-M (Midline approach). Both groups were further sub-divided into two subgroups, each comprising of 6 cats, based on age. Thus, there were total four subgroups which were named as Fy, My, Fa, Ma. The cats in subgroup-Fy, My, Fa and Ma were aged about 7.17±0.61, 7.50±0.76, 29.67±3.71 and 33.00±3.54 months respectively. The subgroup-Fy, My, Fa and Ma were weighing 1.72±0.12, 1.75±0.14, 3.73±0.24 and 4.02±0.16 kg respectively. The incision length was 1.65±0.11, 1.95±0.12, 2.82±0.13 and 2.88±0.23cm in subgroup-Fy, My, Fa and Ma, respectively. The incision length was given shorter in subgroup-Fy than that of all subgroups of cats. The duration of operation was 23.50±1.31, 31.50±1.52, 24.50±1.48 and 28.33±0.92 min in subgroup-Fy, My, Fa and Ma, respectively. The duration of operation was significantly taken higher ($P<0.05$) in subgroup-My than other subgroups of cats. The wound healing period was 11.67±0.99, 14.84±0.95, 10.67±1.15 and 14.50±00.89 days in subgroup-Fy, My, Fa and Ma, respectively. The wound healing in sub-group-My and Ma, took significantly ($P<0.05$) more duration than other subgroups of cats. Gross changes like erythema, dehiscence and discharge after 18-24 hours of surgery scored significantly higher ($P<0.05$) 1.75, 0.50, 0.50 in subgroup-My, whereas swelling was scored significantly higher ($P<0.05$) in sub-group-Fa. Gross changes like swelling, erythema, dehiscence and discharge after 10-14 days of surgery were significantly ($P>0.05$) not subsided in subgroup-My as compared to other subgroups of cats. Complications rate was higher (24%) in subgroup-My and Ma than subgroup-Fy and Fa, while subgroup-Fa found with minimum complications rate (3%). It is concluded that ovariohysterectomy through flank approach is superior to the midline approach due to convenience, reliability, faster healing, rapid recovery and less postoperative complications. Further, it is concluded that ovariohysterectomy is suitable to perform in adult cats.

KEY WORDS: Comparative Midline Flank Approaches Ovariohystrectomy Cats

INTRODUCTION

Over population of unwanted and stray cats is a major problem over the years in Pakistan, and continues to be a problem in all the countries of the world (Bloomberg, 1996). The signs of estrus in small animals are the major reasons for pet owners to seek veterinary advice. Suppression of estrus is frequently required in order to avoid vaginal bleeding, attraction of males, behavioral changes and undesired mating (Valle and Junior 1999). In the cat, behavioral signs of estrus such as abnormal and frequent vocalization, affectionate head rubbing to owners, rolling, treading, lordosis, nymphomania, tail deviation, and attraction of toms have been described as reasons for ovariohysterectomy (Nelson and Couto, 2003 and Heffelfinger, 2006).

Neutering is one of the oldest surgical procedures performed on domestic animals but there is little scientific information regarding the ideal age for neutering cats. Traditionally, in the UK, cats have been neutered after the age of 6 or 7 months but many female cats, particularly those living in the feral state, become pregnant before this age (1). Early age or pre-pubertal altering (EAA) refers to gonadectomy (spay or neuter) between six and sixteen weeks of age and is now commonly practiced as veterinarians gain experience with pediatric anesthesia and surgery (Susan, 2006).

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Ovariohysterectomy eliminates the risk of pyometra and reduces the incidence of pseudo pregnancy and other studies have revealed increased longevity for neutered animals when compared to sexually intact animals (Michell, 1999 and Moore *et al.*, 2001). Ovariohysterectomy is treatment of choice for most uterine diseases including pyometra, uterine torsion, localized or diffuse cystic endometrial hyperplasia, uterine rupture, and uterine neoplasia (Stone, 2003).

Ovariohysterectomy is a routine procedure that is recommended as one means of population control in cats (Levy *et al.*, 2003). It is commonly carried out either through midline coeliotomy or through flank laparotomy. The flank approach is believed to be preferred in UK, whereas the midline approach is preferred in the USA. There have been two small studies comparing these two surgical approaches in cats (Hoque 1991, Ghanawat and Mantri 1996).

Surgical methods where the gonads are removed, are ovariectomy (OVE) or ovariohysterectomy (OVH), through the linea alba or via the flank or laparoscopy (Davidson *et al.*, 2004 and Devitt *et al.*, 2005). Flank ovariectomy by the bilateral method was the first method of ovariectomy described in history in 1857 (Okkens, 1981). The ventral midline method was described after 1900 (Okkens, 1981). The ventral approach, which is most widely used, has some advantages and disadvantages. Midline approach is preferable, predominantly because the uterus sometimes cannot be identified from the flank approach, and it is difficult to be certain whether this is a technical problem or the cat has already been neutered, without exploring from a midline approach. Certain rare congenital abnormalities, such as uterus unicornis, may also be difficult to identify or deal with from the flank approach. With the flank approach, if the ovarian or cervical pedicles are lost before they are ligated, they may be difficult to recover (Coe *et al.*, 2006).

Conditions for which the lateral flank approach for ovariohysterectomy is indicated include excessive mammary gland development due to lactation or mammary gland hyperplasia. When it is 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 leakage 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. Advantages of the lateral flank approach for ovariohysterectomy include the ability to observe the surgical wound from a distance and reduce potential for evisceration if wound dehiscence occurs (Holly and Hardie, 2004). The present study was designed to compare and evaluate flank and midline approaches in cats for ovariohysterectomy.

MATERIALS AND METHODS

Twenty-four intact feral/stray cats with mean age of 11.97±2.1 months and body weight between 2.80±0.16 kg were procured from Tandojam and kept in Indoor Patient Ward, Department of Surgery and Obstetrics Sindh Agriculture University, Tandojam. One month of acclimatization period was given to cats in the department.

Table-1 Experimental Design:

Groups	Approaches	Sub groups	Cats
F	**Flank**	**Fy**	Fy1, Fy2, Fy3, Fy4, Fy5, Fy6
		Fa	Fa1, Fa2, Fa3, Fa4, Fa5, Fa6
M	**Midline**	**My**	My1,My2,My3,My4,My5,My6
		Ma	Ma1,Ma2,Ma3,Ma4,Ma5,Ma6

Fy= young queens that were approached through flank
My= young queens that were approached through midline
Fa= adult queens that were approached through flank
Ma= adult queens that were approached through midline

Cats were divided into two groups based on surgical approaches for ovariohysterectomy i.e. Group-F (Flank approach) and Group-M (Midline approach), placing 12 cats in each group. Both groups were further subdivided into two subgroups, each comprising of 6 cats, based on age to determine the suitable age for ovariohysterectomy in cats. The subgroups “Fy” and “My” had young cats, while the second subgroup i.e. “Fa” and “Ma” had adult cats. Thus, there were total four subgroups which were named as Fy, My, Fa, Ma (Table-1). Flank ovariohysterectomy was performed as suggested by Shuttleworth and Symthe, (2000) and midline ovariohysterectomy was performed as described by Fingland (1998). In order to evaluate the best approach for ovariohysterectomy, various parameters such as post-surgical complications, and time of wound healing and suitable age for surgery was measured and compared between experimental groups and the data was statistically analyzed.

OVARIOHYSTERECTOMY

Pre-operative preparations

Cats were being off fed and water was withheld for twelve hours before surgical intervention. Normal physiological parameters were recorded. Surgical area for flank and ventral midline approaches was prepared by clipping the hair and removing the grease, dust by applying Dettol solution. Then incision site was aseptically prepared by application of Tincture of Iodine.

Anaesthetic protocol

Cats were pre-anesthetized with Acepromazine at recommended dose of 0.2 mg/kg body weight and diazepam at dose of 0.5mg/kg b.w. Cats were anesthetized with Ketamine Hcl at recommended dose of (10 mg/kg, b.w. i/m) as suggested by Howe, (1997).

Statistical analysis

The obtained data was presented in Mean (± SEM) and analysis of variance was calculated by using computerized statistical package SPSS 11.5.

Table-2 Mean values of parameters recorded before and during laparotomy in cats of Group-F and Group M Surgical approaches

Parameters	Mean ± SE			
	Subgroup- Fy	Subgroup-My	Subgroup-Fa	Subgroup-Ma
Weight (kg) of cats.	1.72±0.12	1.75±0.14	3.73±0.24	4.02±0.16
B. Temperature (ºF) before anesthesia	100.4±0.15	101.2±0.17	101.6±0.12	102.±013
B. Temperature (ºF) after anesthesia	102.8±0.13	102.6±0.10	102.4±0.18	102.8±0.18
Respiratory rate (breath/min) before anesthesia	32±0.11	36±0.13	38±0.10	36±0.17
Respiratory rate (breath/min) after anesthesia	24±0.75	26±0.71	28±0.91	20±0.71
Heart beat (beat/min) before anesthesia	110±2.31	114±2.12	108±1.14	120±1.16
Heart beat (beat/min) after anesthesia	130±2.30	134±2.31	124±2.15	128±2.30
Capillary refill time (second) after anesthesia	4±0.33	4±0.25	3±0.30	3±0.47
Recovery from anesthesia (min)	32±1.03	34±1.69	27±1.69	30±1.83
Simple continuous stitches using chromic catgut 3/0 for closure of peritoneum	5±0.30	5±.21	4±0.26	5±0.29
Duration of peritoneum closure (min)	2.5±0.10	3±0.17	2±0.18	2.5±0.16
Simple continuous stitches using chromic catgut 3/0 for closure of muscle layer	4±0.20	5±0.22	3±0.12	4±0.14
Duration for closure of muscle layer (min)	3±0.11	3±0.13	2±0.14	2±0.16
Simple continuous stitches using chromic catgut 3/0 for closure of sub-cut layer	6±0.12	5±0.14	4±0.16	4±0.11
Duration for closure of sub-cut layer (min)	3±0.17	3±0.18	2±0.19	2±0.22
Simple interrupted stitches using silk (3/0) for closure of skin	3±0.22	4±0.23	3±0.21	3±0.25
Duration for the closure of skin (min)	2±0.18	2.5±0.25	2±0.17	2±0.20
Total duration for laparotomy (min) closure with layered method	8.5±0.10	9±0.12	6±0.16	6.5±0.23

Ovariohysterectomy operations were performed through midline approach on cats as described by Fingland, (1998) while flank approach was performed through vertical flank as described by Shuttleworth and Smythe, (2000).

SURGICAL PROCEDURE

Midline approach

The cats were prepared for the surgery and urinary bladder was manually evacuated before ovariohysterectomy. The cats were positioned in dorsal recumbency on the operating table and their fore limbs and hind limbs were tied with straps. An area of approximately 3×3 inches having about one inch cranial and two inches caudal to the umbilicus was clipped with hair clipper. The clipped area was scrubbed and prepared aseptically with pyodine. Sterilized drapes were applied and clamped exposing an area of just about 2.5 ×2.5 inches for the surgery.

A midline abdominal incision was made on the skin, with sterile surgical blade No.23, approximately 1 cm caudal to the umbilicus and extended about 3 to 5 cm caudally. The subcutaneous tissue was lifted with Allis tissue forceps and was cut down with scissor. Any disturbing fat was also removed and linea alba was visualized as thin white line between muscles. Linea alba was lifted with Allis tissue forceps and a small stab incision was given with upward direction of cutting edge of scalpel. Scissor was inserted into the small stab incision and the linea alba was opened

equal to the size of skin incision by taking extreme precaution not to damage any under lying structures. Then left uterine horn was exteriorized by ovariohysterectomy hook. A small hemostat was placed across the proper ligament to aid in the caudal retraction of ovary. The ovary was grasped between the thumb and the middle finger and the index finger was placed as far proximal as possible on the suspensory ligament and tension was placed on the suspensory ligament by rotating the index finger caudally and gradually tension on suspensory ligament was increased until the ligament broke. The ovarian arteriovenous complex was identified and by using artery forceps an opening was made in the mesovarian immediately caudal to the ovarian arteriovenous complex in an area clear of vessels and fat. The first clamp was placed immediately proximal (towards the aorta) to the ovary and the second clamp approximately 5 mm proximal to the first. A third clamp was placed across the proper ligament between the ovary and uterine horn and the ovarian arteriovenous complex was transected between the middle clamp and the ovary. Placing tension on the ovarian arteriovenous complex was avoided during manipulation of suspensory ligament and while placing ligature. A circumferential ligature using chromic catgut 3/0 was loosely placed around the proximal clamp and was tightened as the clamp was removed so that way it got tightened in the groove of crushed tissue created by clamp. The ligated ovarian arteriovenous complex was grasped in the thumb forcep and the middle clamp was removed and inspected for bleeding before leaving it back into the abdominal cavity. Then, left uterine horn was followed distally to the bifurcation and right uterine horn was located and was followed proximally to the right ovarian arteriovenous complex. Same method of ligation and transaction was used for the right ovarian arteriovenous complex as was performed on left side. A window was made in broad ligament adjacent to the uterine artery and vein, vessels were ligated with chromic catgut 3/0 and broad ligament was grasped and torn. The uterine body and cervix was exteriorized and clamps were applied immediately proximal to the cervix. The uterine body was hold and ligated with circumferential sutures using chromic catgut 3/0. The clamp was removed and uterine stump was evaluated for bleeding and then replaced in the abdomen. Then, abdominal incision was closed, the linea alba and subcutaneous tissues were closed with chromic catgut using simple continuous suture pattern. The skin was closed with silk using simple interrupted suture pattern. Antiseptic was applied and the cats were shifted from operation theater to the Indoor Patient Ward after ensuring recovery from anesthesia.

Flank approach

The cats were prepared for the surgery and urinary bladder was emptied by applying digital pressure before ovariohysterectomy. The cats were positioned in right lateral recumbency on the operating table and their fore limbs and hind limbs were tied with straps, the left pelvic extremity was pulled slightly caudally. An area from the prominence of the lateral rim of the ilium to the lower abdominal line and from the front of the thigh to the costal arch was clipped. The shaved area was scrubbed and prepared aseptically with tincture of iodine. Sterilized drape with approximately 1.5×1.5 inches was placed over skin.

A slightly oblique incision of approximately 2.2±0.12 cm long according to the size of cat was made below the rim of ilium. It was approximately along the cranial border of the tensor fasciae latae muscle. The center of the incision was at the junction of the middle and lower third of the distance between the dorsum and lower abdominal border. The left hand was placed on the drapes with fingers on lumber spine and with the thumb, abdominal wall was compressed. A slight pressure caused the abdomen to bulge between thumb and fore finger.

A toothless thumb forcep was inserted into the skin opening and was directed straight downward. The jaws of the forcep were spread using hand and muscular opening was enlarged separating the fibers of oblique muscles. Through the opening uterus was seen floating on top of abdominal contents just dorsal to the urinary bladder. Uterus was exteriorized with the help of spay hook. The left horn was grasped and was followed along its course to the left ovary. The same procedure for removal of ovary and uterus was applied as described for ventral approach.

Post-operative care

Antiseptic was applied at the incision site after suturing. Antibiotics were given to cats to avoid secondary infections. Anti-inflammatory and analgesics were given to reduce inflammation and pain. After healing of wound suture stitches were removed after 10 days. Soft food was offered to the operated cats up to the complete healing.

Appearance of wound/ gross changes

The clinical appearance of wound was scored at two time points 18 to 24 hours and 10 to 14 days post-surgery. Wounds were scored based on swelling, dehiscence and discharge. Scoring system was adopted as suggested by Sylvestre and Wilson (2002)

RESULTS

The study was carried out to compare midline and flank approaches for ovariohysterectomy in cats at Department of Surgery and Obstetrics, Sindh Agriculture University Tandojam during 2013. The following parameters were

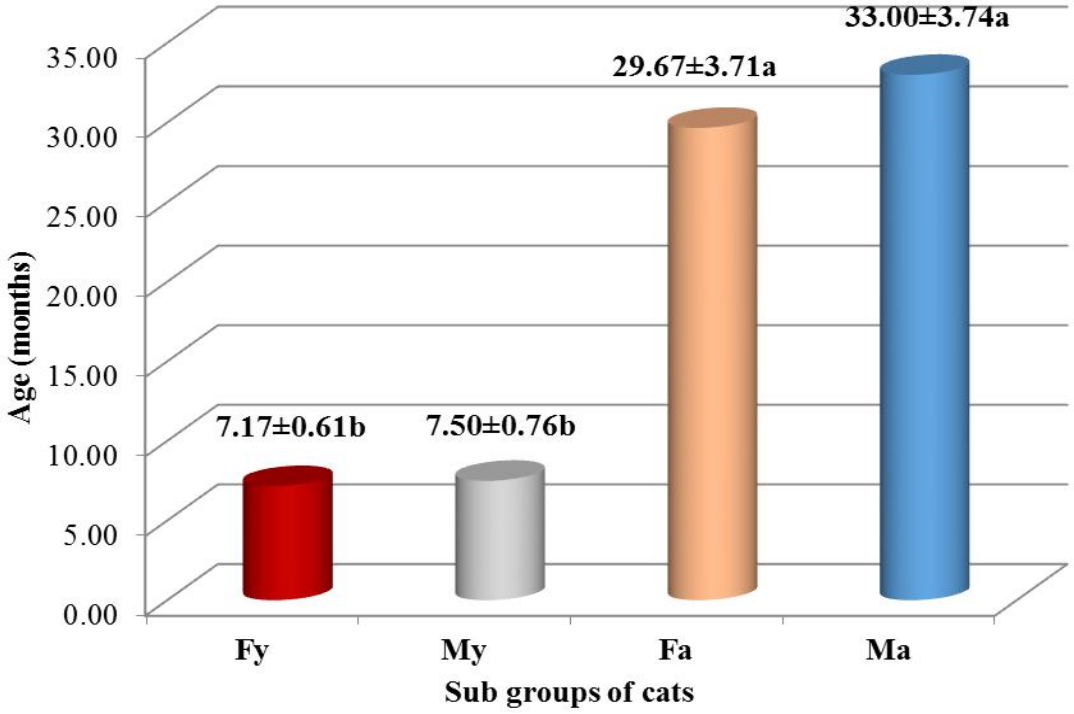
studied: age, weight, incision length, duration of operation (min), duration of wound healing (days), gross wound appearance, histological characterization of wound healing and complications arising from flank and midline approaches for ovariohysterectomy. The results are given below.

1 Age of cats in subgroup Fy, My, Fa and subgroup Ma

The four subgroups of cats were operated through flank and midline approaches for ovariohysterectomy and the age of cats was recorded which is presented in the Figure-1, Appendix- I & II. The age of cats in subgroup-Fy was 7.17±0.61 and in subgroup-My was 7.50±0.76 months, while the age of cats in subgroup-Fa was 29.67±3.71 and in subgroup-Ma was 33.00±3.54 months.

Statistical analysis (ANOVA) revealed that the age of cats in subgroup-Fa and subgroup-Ma was significantly (P<0.05) higher than that of subgroup-Fy and subgroup-My. However, least significant difference (LSD; 0.05) among the means illustrated that the subgroup-Fy and subgroup-My found with similar (P>0.05) age within the group, and subgroup-Fa and subgroup-Ma were also similar (P>0.05) with each other.

Figure 1. Age of young and adult cats in Group-F and Group-M



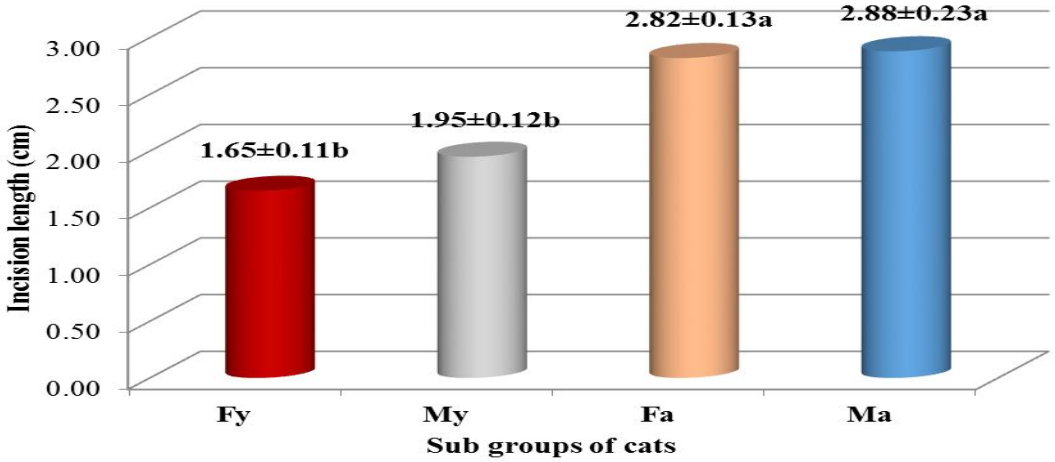
LSD (0.05) = 7.6816
SE± = 3.6825
Fy = **Flank young**
My = **Midline young**
Fa = **Flank adult**
Ma = **Midline adult**

2 Length of skin incision (cm) in cat of Group-F and Group-M

The incision length (cm) in cats of all subgroups was recorded those were operated through flank and midline approaches for ovariohysterectomy. The results are presented in the Figure-2, Appendix-III & IV. The length of incision in subgroup-Fy was 1.65±0.11 in subgroup-My was 1.95±0.12 cm in length. However, the length of incision in subgroup-Fa was 2.82±0.13 and in subgroup-Ma was 2.88±0.23cm for ovariohysterectomy.

Statistically (ANOVA) the incision length in subgroup-Fa and subgroup-Ma was significantly higher (P<0.05) than that of sub group Fy and subgroup-My. Further the LSD (0.05) revealed that the subgroup-Fy and My were incised with similar (P>0.05) length and subgroup-Fa and Ma were also given incision with statistically similar (P>0.05) length (cm).

Figure 2. Length of skin incision (cm) in cat of Group-F and Group-M



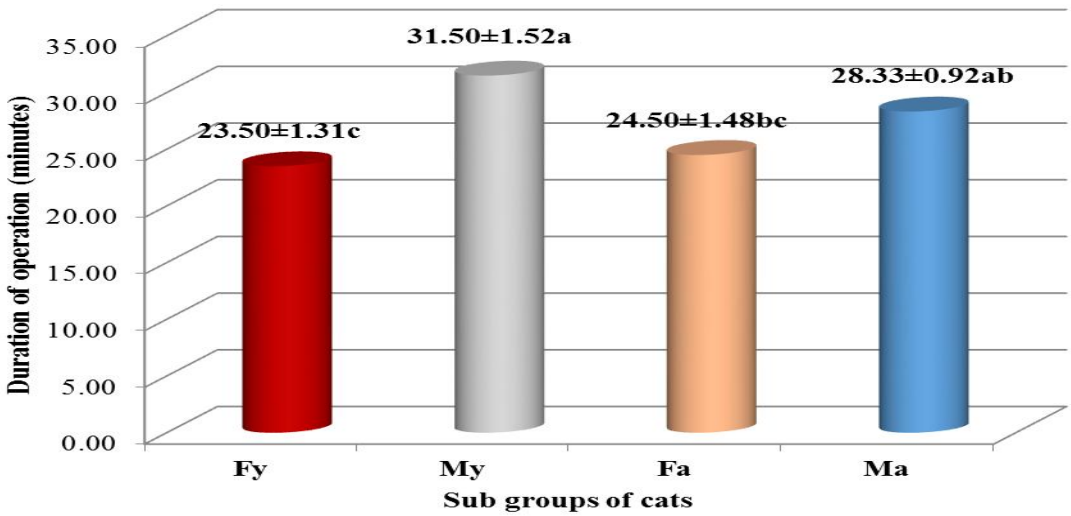
LSD (0.05) = 0.4544
SE± = 0.2178
Fy = **Flank young**
My = **Midline young**
Fa = **Flank adult**
Ma = **Midline adult**

3 Duration (minutes) for ovariohysterectomy in cat of Group-F and Group-M

The duration (minutes) for ovariohysterectomy in subgroups Fy, My, Fa and Ma were recorded and results are presented in the Figure-3, Appendix-V & VI. The average duration of operation was 23.50±1.31 min in subgroup-Fy and in subgroup My was 31.50±1.52 min. However, the mean time taken in subgroup Fa was 24.50±1.48 min and in subgroup-Ma was 28.33±0.92 min.

Further statistical analysis (ANOVA) revealed that the duration of ovariohysterectomy was significantly more ($P<0.05$) in subgroup-My followed by subgroup-Ma and Fa. Whereas, in subgroups-Fy and Fa the duration of operation was not significantly different ($P>0.05$) than in subgroup-Fy and Fa.

Figure 3. Duration of ovariohysterectomy (minutes) in cat of Group-F and Group-M



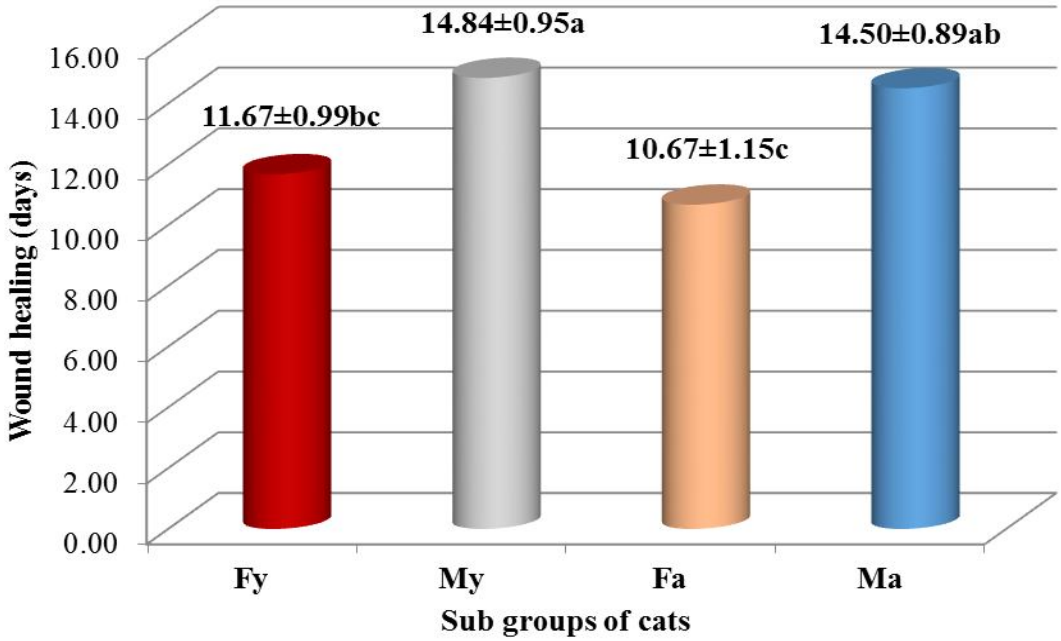
LSD (0.05) = 3.9195
SE± = 1.8790
Fy = **Flank young**
My = **Midline young**
Fa = **Flank adult**
Ma = **Midline adult**

4 Duration (days) of wound healing in cat of Group-F and Group-M

Duration of wound healing (days) in all the subgroups of cats which were operated through flank and midline approaches for ovariohysterectomy was recorded and results are presented in the Figure-4, Appendix-VII & VIII. The average wound healing days were 11.67±0.99 in subgroup-Fy and in subgroup-My was 14.84±0.95 days. However, the mean days taken during the wound healing for subgroup-Fa were 10.67±1.15 and for subgroup-Ma were 14.50±00.89 days.

Further analysis (ANOVA) revealed that the duration of wound healing was significantly high (P<0.05) in subgroup-My followed by subgroup-Ma, subgroup-Fy and subgroup-Fa, whereas the duration of wound healing was statistically similar (P>0.05) between subgroup-Fa and sbugroup-Fy.

Figure 4. Wound healing (days) of young and adult cats in Group-F and Group-M



LSD (0.05) = 2.9377
SE± = 1.4083
Fy = **Flank young**
My = **Midline young**
Fa = **Flank adult**
Ma = **Midline adult**

5 Wound appearance/gross changes

Wound appearance/gross changes like swelling, erythema, dehiscence and discharge in Group-F and were observed and score was rated after 18 – 24 hours and 10- 14 days of surgery, and results are depicted in Table 3. It was found that the average score for swelling was rated significantly higher (P<0.05) in subgroup-Fa (2.00) in subgroup-Fy (1.75) and in subgroup-My and Ma (0.75) after 18- 24 hrs. The average score perceived for erythema was significantly higher (P<0.05) in subgroup-My (1.75) followed by subgroup-Ma (1.25), subgroup-Fy (1.00) and subgroup-Fa (0.75). Only subgroup-My was scored as (0.50) for dehiscence, while in other subgroups of cats were not found with dehiscence after 18 – 24 hrs. In subgroup-My significantly higher (P<0.05) discharge was scored (0.50) followed by subgroup-Ma (0.25). Whereas, in subgroups-Fy and Fa was scored zero.

Wound appearance was also observed on 10 – 14 days after surgery and gross changes were analyzed. The average score for swelling was rated significantly higher (P<0.05) in subgroup-My (0.75) and subgroup-Ma (0.50) than subgroup-Fy (0.25) and subgroup-Fa (0.00) after 18- 24 hrs. The average score for erythema was significantly higher (P<0.05) in subgroup-My (0.75) and subgroup-Ma (0.75) followed by subgroup-Fy (0.25), and subgroup-Fa (0.00). Only in subgroup-My dehiscence was scored (0.25) while other subgroups of cats were not found with dehiscence after 10 – 14 days. Subgroup-My was scored (0.50) significantly higher (P<0.05) for discharge from the wound, whereas subgroup-Fy and subgroup-Fa was scored zero.

Table: 3. Mean score for gross changes and skin wound appearance in cat of Group-F and Group-M

Wound appearance/ Gross changes	Mean scores				LSD (0.05) SE±
	Group-Fy	Group-My	Group-Fa	Group-Ma	
18-24 Hrs					
Swelling	1.75[a]	0.75[b]	2.00[a]	0.75[b]	0.917±0.43
Erythema	1.00[ab]	1.75[a]	0.75[b]	1.25[ab]	0.917±0.42
Dehiscence	0.00[b]	0.50[a]	0.0[b]	0.0[b]	0.446±0.21
Discharge	0.00[a]	0.50[a]	0.00[a]	0.25[a]	0.588±0.27
10-14 days					
Swelling	0.25[ab]	0.75[a]	0.0[b]	0.50[ab]	0.703±0.33
Erythema	0.25[ab]	0.75[a]	0.0[b]	0.75[a]	0.667±0.31
Dehiscence	0.00[a]	0.25[a]	0.00[a]	0.00[a]	0.385±0.18
Discharge	0.00[b]	0.50[a]	0.00[b]	0.00[b]	0.448±0.20

[ab] Means within a row having different superscripts are significantly different (P<0.05)

Complications rate (%) of wound in cat of Group-F and Group-M

All possible types of complications like evisceration, hernia, suture dehiscence, maggot infestation, infection of wound and tearing of tissue were observed in Group-F and Group-M for ovariohysterectomy and complication rate in cats are presented in Table-3. In subgroup-My 33.33% were observed for evisceration, suture dehiscence, infection of wound and tearing of tissue. While it was 16.67% for hernia. However, Group-F has relatively similar percentage 16.67 % for evisceration, suture dehiscence, infection of wound and tearing of tissue whereas, it was 0.0% for hernia. In subgroup-Fa had 16.67% tearing of tissue while not a single cat in subgroup (0.0%) observed for evisceration, hernia, suture dehiscence and infection of wound. Moreover, in subgroup-Ma had similar percent 33.33% for hernia, suture dehiscence, infection of wound and tearing of tissue while it was 16.67% for evisceration. Further, it was evaluated that not a single cat found to be with maggot infestation in Group-F and Group-M.

Table: 3. Complications observed after ovariohysterectomy in cat of Group-F and Group-M

Type of complication	Complication rate (%)			
	Group-Fy	Group-My	Group-Fa	Group-Ma
Evisceration	16.67	33.33	0.00	16.67
Hernia	0.00	16.67	0.00	33.33
Suture dehiscence	16.67	33.33	0.00	33.33
Maggot infestation	0.00	0.00	0.00	0.00
Infection of wound	16.67	33.33	0.00	33.33
Tearing of tissue	16.67	33.33	16.67	33.33
Overall complication rate %	11.11%	24.9%	3%	24%

DISCUSSION

The domestic cat is very common and popular household pet. However, nowadays there is growing concern not only pet overpopulation but also excess of population of stray or unwanted cats throughout the world. A lot of work has been done around the world to overcome this growing problem, to find out ways of neutering cats by various surgical methods (Ovariohysterectomy, tubal ligation, ovariectomy, salpingectomy or hysterectomy) and nonsurgical methods (use of chemical sterilants, cytotoxins and vaccines) Bloomberg (1996) and Kustritz (1996) reported that out of all contraceptive methods, ovariohysterectomy was very common and is preferred by most practitioners and clients because it was not only controlled the population but there was also a seven times less risk of mammary carcinoma, progesterone mediated mammary hypertrophy. It has also been established that diseases of the uterus and ovaries cannot occur after complete ovariohysterectomy. The present study was conducted to find out best approach and to observe the suitable age that may be convenient for ovariohysterectomy in cats.

In present study, the cats in subgroup-Fy were aged about 7.17±0.61 months and in subgroup-My was 7.50±0.76 months. While, the cats in the subgroup-Fa was aged about 29.67±3.71 months and in subgroup-Ma was 33.00±3.54 months. The age of all subgroups of cats was in the range with that of cats studied by Coe *et al*., (2006), who conducted the experiment to compare flank and midline approaches and they selected the cats from six months to less than 10 years for ovariohysterectomy. However, (1) reported that female cats, particularly those living in the feral state, become pregnant before this age**.** While other researcher (Susan, 2006) indicated that early age or pre-pubertal altering (EAA) refers to gonadectomy (spay or neuter) between six and sixteen weeks of age.

The present study illustrated that subgroup-My were incised with the more length (1.95±0.12 cm) than subgroup-Fy (1.65±0.11cm), but the difference was non-significant (P>0.05). The subgroup-Fa was incised with shorter length (2.82±0.13cm) than that of subgroup-Ma (2.88±0.23cm) for ovariohysterectomy. Similarly, the findings of Coe, *et al.*,

(2006) supported the results of present study, they found the mean incision length was higher (3.1±0.6cm) in midline approach than in flank incision (2.6±0.2cm) in cats for ovariohysterectomy. Relatively shorter incision length for flank (2.2±0.33cm) approach was used as compared to midline (2.68±0.27cm) approach by Rana, 2007, Ghanawat and Mantri, 1996, Shuttle worth and Smythe 2000. The reason for shorter incision length in the flank approach was that, it was easy and convenient to provide better accessibility and localization as compared to midline approach (Rana, 2007).

The present study showed that the average duration of operation in subgroup-Fy was similar ($P>0.05$), (23.50±1.31min) and in subgroup-Fa was (24.50±1.48min) but significantly less ($P<0.05$) than that of subgroup-My (31.50±1.52 min) and subgroup-Ma (28.33±0.92 min). Similarly, it was also reported in other study (Rana, 2007) that the duration of operation was significantly less in cats operated through flank (24±2.65min) approach than the midline (29±3.51min). Coe, *et al*., (2006) observed that the duration of operation through flank was 41±12min and it was 43±11min for cats operated through midline approach. However, duration of operation was reported more than the present study and that may be due to the age and weight of cats being operated. The findings of Chaudry and Iqbal (1988) also were in agreement with the results of present study, as they reported that duration of operation was more in cats operated through midline than that of operated through flank approach.

In present study wound healing was observed relatively faster in subgroup-Fa was (10.67±1.15days) followed by subgroup-My (11.67±0.99days), subgroup-Ma (14.50±00.89days) and subgroup-My (14.84±0.95days). The results are in line with the findings of Rana (2007) who reported that wound healing was better and faster in the flank approach as compared to ventral midline approach. Author categorized the wound healing days into three different categories (i.e. ≤ 7, 8-14, >14 days) and found that wound healing was 50% in flank approach during ≤7 days and remaining (50%) healed between 8-14 days whereas, healing occurred 16.66% during ≤ 7 days, 50% between 8-14 and 33.33% in more than 14 days.

Wound appearance/gross changes

In present study it was found that the average score for swelling was significantly higher ($P<0.05$) in subgroup-Fa (2.00) and subgroup-Fy (1.75) than subgroup-My was (0.75) and subgroup-Ma was (0.75) after 18- 24 hrs. While after 10- 14 days of operation the average score for swelling was rated significantly higher ($P<0.05$) in subgroup-My (0.75) and in subgroup-Ma (0.50) than subgroup-Fy (0.25) and subgroup-Fa (0.0). Sylvestre and Wilson (2002) reported the higher score for swelling of wound after 18-24 hrs (score, 0.50) than that of 10-14 postoperative days (score, 0.30) of ovariohysterectomy. The increased swelling of wound during the first 18– 24 hrs might be due to implanted suture material identified by immune system as foreign material and the inflammatory response described as a foreign body reaction. In another study (Muir *et al.*, 1993) observed increased incisional swelling after 24 hrs of post operation in cats. The differences in score received for swelling of wound between two approaches noted and any difference in postoperative pain between two approaches could be due to differences in the sensitivity of the skin of the flank and midline (Burrow *et al*., 2006).

The average score perceived for erythema was significantly higher ($P<0.05$) in subgroup-My (1.75) followed by subgroup-Ma (1.25), subgroup-Fy (1.00) and subgroup-Fa (0.75) after 18-24 hrs, Whereas after 10-14 days of operation erythema was observed as significantly higher ($P<0.05$) in subgroup-My (0.75) and subgroup-Ma (0.75) followed by subgroup-Fy (0.25), and subgroup-Fa (0.00). The study conducted by Sylvestre and Wilson (2002) support the observations of present study, they found the increased erythema in the wound during the first 18 – 24 hrs (score, 0.88) than that of 10-14 postoperative days (score, 0.11). It is argued that early increase in erythema in wound might be due to implanted suture material and tissue reaction (Sylvestre and Wilson (2002).

In present study the mean score for dehiscence was 0.50 and 0.25 in the wound during 18 – 24 hrs and 10 -14 days of post operation in subgroup-My respectively, while other subgroups of cats were not found with dehiscence (score, 0.0). However, Sylvestre and Wilson (2002) reported that no dehiscence (Score, 0.0) in the wound was found during first 18-24 hrs as well as after 10-14 days of operation in dogs operated for ovariohysterectomy. One subgroup-My which was scored for dehiscence may be due to the approach and age of cats (Coe *et al*., 2006).

In current study after 18– 24 hrs of operation, subgroup-My perceived the score for discharge as higher (0.50) than that of subgroup-Ma (0.25), whereas subgroup-Fy and subgroup-Fa scored zero. After 10-14 days of operation subgroup-My perceived the score significantly higher ($P<0.05$), (0.50) for discharge from the wound, whereas subgroup-Fy, subgroup-Fa and Ma perceived score zero. However, Sylvestre and Wilson (2002) reported that the animal operated for Ovariohysterectomy received the score for discharge in wound as 0.12 after 1- 14 days of operation. However, in present findings the score was higher for discharge during early period and in wound operated through midline approach may be a result of seroma, bacterial infection or haemorrhage is reported by Coe *et al*., 2006. The higher incidence of discharge might be also due to excessive intra-abdominal pressure of organs (Rana, 2007).

In present study the overall complications (evisceration, hernia, suture dehiscence, maggot infestation, infection of wound and tearing of tissue) rate was found to be higher (24%) in subgroup-My and subgroup-Ma, while subgroup-

Fa were found with minimum complications rate (3%). However, other Researchers (Freeman *et al.,* 1987 and Muir *et al.,* 1993) also observed that the postoperative wound complications rate was higher in midline approach (47 and 80 percent, respectively) for the ovariohysterectomy of cats. That might be due to excessive suture tension and intra-abdominal pressure on midline, which is not found on flank approach.

SUMMARY, CONCLUSIONS AND SUGGESTIONS

Summary:

The study was carried out to compare midline and flank approaches for ovariohysterectomy in cats at department of surgery and obstetrics, Sindh agriculture university Tandojam during 2013. The parameters studied in this study were age, weight, incision length, duration of operation (min), duration of wound healing (days), gross wound appearance, histological characterization of wound healing and complications arising from flank and midline approaches for ovariohysterectomy. Cats were divided into two groups based on surgical approaches for ovariohysterectomy Group-F (Flank approach) and Group-M (Midline approach). Both groups were further sub-divided into two subgroups, each comprising of 6 cats, based on age. Thus, there were total four subgroups which were named as Fy, My, Fa, Ma. The results are summarized as under:

The cats in subgroup-Fy, My, Fa and Ma were aged about 7.17±0.61, 7.50±0.76, 29.67±3.71 and 33.00±3.54 months, respectively. The incision length was 1.65±0.11, 1.95±0.12, 2.82±0.13 and 2.88±0.23cm in subgroup-Fy, My, Fa and Ma, respectively. The duration of operation was 23.50±1.31, 31.50±1.52, 24.50±1.48 and 28.33±0.92 min in subgroup-Fy, My, Fa and Ma, respectively. The wound healing period was 11.67±0.99, 14.84±0.95, 10.67±1.15 and 14.50±00.89 days in subgroup-Fy, My, Fa and Ma, respectively.

Gross changes like erythema, dehiscence and discharge after 18-24 hours of surgery scored as 1.75, 0.50, 0.50 in sub-group-My, respectively whereas swelling was scored significantly higher ($P<0.05$) in sub-group-Fa. Gross changes like swelling, erythema, dehiscence and discharge after 10-14 days of surgery were not significantly ($P<0.05$) subsided in subgroup-My as compared to other subgroups of cats.

Complications rate was higher (24%) in subgroup-My and Ma than subgroup-Fy and Fa, while subgroup-Fa found with minimum complications rate (3%).

CONCLUSIONS

It is concluded from the present study that:

- Adult age is suitable to perform ovariohysterectomy in cats.
- The length of incision required for ovariohysterectomy is less through flank approach than the midline.
- Duration of operation for ovariohysterectomy through flank is shorter than the midline.
- The rate of complications (Evisceration, Hernia, Suture dehiscence, Maggot infestation, Infection of wound, Tearing of tissue) are more through midline than the flank approach for ovariohysterectomy.
- The flank approach was superior to the midline approach due to faster healing and less complications.

Suggestions:

It could be suggested that:

- Ovariohysterectomy should be performed through flank approach in our environmental conditions as healing takes place faster in this approach.
- Further studies can be carried out to compare the midline and flank approaches for ovariohysterectomy in canine.

REFERENCES

1. Burrow, R., E. Wawra and G. Pinchbeck. 2006. Prospective evaluation of postoperative pain in cats undergoing ovariohysterectomy by a midline or flank approach. Vet. Rec. 158 (19) : 657-661.
2. Bloomberg, M.S., 1996. Surgical neutering and non-surgical alternatives. J. Am. Vet. Med. Assoc. 208(4): 517-519.
3. Chaudhry, N.I. and M. Iqbal, 1988. A simple technique for ovariohysterectomy in the cat. Pak.Vet. J.8(3) 149- 151.
4. Coe, R. J., N. J. Grint, M. S. Tivers, A. Hotston Moore and P. E. Holt. 2006. Comparison of flank and midline approaches to the ovariohysterectomy of cats. Vet. Rec. 159 (3) :309-313.
5. Davidson, E.B., H.D. Moll and M.E., Payton. 2004. Comparison of laparoscopic ovariohysterectomy and ovariohysterectomy in dogs. Vet. Surg. 33 : 62-69.

6. Devitt, C.M., Cox, R.E., and Hailey J.J., 2005. Duration, complications, stress, and pain of open ovariohysterectomy versus a simple method of laparoscopic assisted ovariohysterectomy in dogs. J. Am. Vet. Med. Assoc. 227 : 921-927
7. Fingland, R.B. 1998. Surgery of the ovaries and uterus. In.S.J. Birchard and R,G, Sherding (editors), Saunders Manual of Small Animal Practice 2nd ,W.B. Saunders: Philadelphia, p. 1029-1036.
8. Freeman, L. J., G. D., Pettit, D., Robinette, J. Lincoln & M. W., Person. Tissue reaction to suture material in the feline linea alba – a retrospective, prospective and histological study. Vet. Surg. 1987. 16: 440-44
9. Ghanawat, H.G. and M. B. Mantri,. 1996. Comparative study of different approaches for ovariohsterectomy in cats. Indian Vet. J. Surg. 73, 987-988
10. Hoque, M. 1991. Comparative study of various approaches to feline ovariohysterectomy. Ind. J. of Vet. Surg. 12, 29-30
11. Holly M.G. and R.J. Hardie. 2004. Lateral Flank Approach for Ovariohysterectomy in Small Animals. Vet. Med. Small Anim. Clin. 70 (5) : 569–573.
12. Howe, L.M. 1997. Short-term results and complications of pre pubertal gonadectomy in cats and dogs.J Amer.Vet. Med. Assoc. 211(1):57-62
13. Heffelfinger, D. J. 2006. Ovarian remnant in a 2-year-old queen. The Canadian Vet. J. Ottawa, v. 47, n. 2, p. 165-167
14. Kustritz, M., Elective gonadectomy in cats. 1996. J. Feline Practice 24 (6): 36-39.
15. Levy, J. K., D.W. Gale and L. A. Gale, 2003. Evaluation of the effect of a longterm trap- neuter-return and adoption program on a free-roaming cat population. J. of Am. Vet. Med. Assoc. 222, 42-46
16. Muir, P., Goldsmid, S. E., Simpson, D. J. and C. R. Bellenger, 1993. Incisional swelling following celiotomy in cats. *Veterinary Record* 132**:** 189-190
17. Michell, A. 1999. Longevity of British breeds of dog and its relationships with sex, size, cardiovascular variables and disease. The Vet. Rec. London, 145, (22) : 625-629,
18. Nelson, R. W., and C. G. Couto. 2003. Disorders of the estrous cycle. 3rd In: (Ed.). Small animal internal medicine. Missouri: Mosby, cap.(56): 851-869.
19. Okkens, C., Gaagi, .V.D., Biewengaw, J., Rothuizejn, and Vookhoijt. 1981. Urological complications after ovaryhysterectomy in dogs. *Kjdschrift Diergeneeskunde* 106: 1189-1198
20. Okkens, A.C., H.S. Kooistra and R.F. Nickel. 1997. Comparison of long term effects of ovariectomy versus ovariohystrectomy in cats. J. Reprod. Fertil. Suppl. 51 : 227-231.
21. Rana, M.A. 2007. Comparative study of flank vs midline approach for ovariohysterectomy in cats. UVAS, Lahore (Pakistan). Pp-75.
22. Shuttleworth, A.C., and R.H. Smythe. 2000. Surgical conditions of female organs.Clinical Veterinary Surgery. (2). Green World Publishers, India :484-490.
23. Spain, C.V., J.M. Scarlett and K.A. Houpt. 2004. Long term risks and benefits of pediatric gonadectomy in cats. JAVMA. 224 (3) : 372-379.
24. Sylvestre, A. and J., Wilson. 2002. A comparison of two different suture patterns for skin closure of canine ovariohystrectomy .Can.Vet. J. 43(9): 699-702
25. Susan, L. 2006. Early age altering. The Winn Feline Foundation for the health and well-being of cats. P.1
26. Valle, G. R., and M. Junior., 1999. Endocrinopathology and hormonal therapy of the estral cycle of the bitch. *Caderno Técnico de Veterinária e Zootecnia*, Belo Horizonte, (30) : 49-74.