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Midline and Flank Approaches for Spaying: A Comparative Study in Cats

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ABSTRACT

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The study was conducted to compare midline and flank approaches for spaying in cats. Cats were divided into two groups based on surgical approaches for spaying, Group A (Flank approach) and Group- B (Ventral midline approach). To evaluate the best approach for spaying, various parameters such as length of the surgical incision, the extent of haemorrhage, ease of location and exteriorization of ovaries and uterus, duration of surgery, postoperative complications, and time required for complete wound healing were recorded. In addition, the heart rate, respiration rate, and temperature were recorded before the operation and on different days after the operation. The physical parameters significantly ($P<0.05$) differed between the two groups. In both groups, the average length of skin incision was 2.8 cm. The average time of exteriorization of ovaries and uterus was higher in the ventral midline approach as compared with the flank approach. The average duration of surgery was (23.25±4.20) min in group A and 29.25±4.88 min in group B. The average wound healing time (days) was also higher in the ventral midline approach (16.50±1.26) compared to the flank approach (13.75±7.85). During Spaying in cats, the extent of haemorrhage was mild to moderate in the flank approach, whereas there was no haemorrhage or sometimes less in the ventral midline approach. The post-operative complications were less in flank methods than in ventral midline approaches. It is concluded that spaying through the flank approach is superior to the ventral midline approach due to convenience, faster healing, rapid recovery, and fewer postoperative complications.

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Introduction

Spaying is the most common surgical technique suggested in cats as a method of population control (Levy et al., 2003). A midline coeliotomy or a flank laparotomy is the most prevalent methods of surgery. In Bangladesh, however, both procedures are used according to the surgeon's preference. It is a global concern to manage the number of domestic cats, which creates concerns about the cats' individual welfare (Roberts et al., 2015). The greatest way for reducing the number of cats is to do ovariectomy (OVH), a common treatment (Levy et al., 2003). Surgical methods where the gonads are removed, are ovariectomy or ovariectomy through the linea alba or via the flank or laparoscopy (Davidson et al., 2004, Devitt et al., 2005). Traditional OVH is performed by medial ventral or lateral "Flank" access, which is still not widely regarded as a standard daily procedure in our region and throughout the world. The lateral "Flank" access for OVH at cats is being used worldwide as a result of the excellent response (Slingsby and Waterman-Pearson, 2002). When compared to sexually intact animals, neutering reduces the risk of pyometra and reduces the incidence of pseudo pregnancy. Other studies have also shown that neutered animals live longer (Moore et al., 2001). Most uterine illnesses, including pyometra, uterine torsion, localized or diffuse cystic endometrial hyperplasia, uterine rupture, and uterine neoplasia, are treated with spaying (Stone, 2003). When the queen cat is pregnant or has a uterine pathological condition, a ventral midline approach is the best option. However, there is often more hemorrhage from the skin and subcutaneous tissue, which increases the risk of wound inflammation or infection, and because the site is ventral, wound complications are difficult to detect by the owners (Kiani et al., 2014). As a result, most veterinarians prefer to do cat spaying using the lateral flank method. When excessive mammary gland development owing to lactation or mammary gland hyperplasia occurs in queen cats, it is especially recommended.

Furthermore, in lactating animals, adopting the lateral flank approach reduces disturbance to the mammary glands, allowing the animals to continue nursing normally after surgery. The capacity to view the surgical site from a distance and a reduced risk of evisceration if wound dehiscence occurs are two advantages of the lateral flank technique for spaying (Holly and Hardie, 2004). Unowned or stray cats have become a big problem in Bangladesh, as well as in other nations throughout the world (Levy et al., 2003), raising concerns about individual cat care (Roberts et al., 2015).

In Bangladesh, the number of small or pet animals is rapidly increasing, and pet owners are increasingly concerned about their animals' health and welfare. Thus, this study has a novelty in finding out the preferred surgical protocol with minimal post-operative complications for spaying and may provide vast knowledge on clinical management of spaying in cats, which in turn, could help to carry out in depth research on reproductive disorders on all livestock populations. Therefore, the research work was done to compare the ventral midline and flank approaches for spaying in cats in relation to the incision size, ease of isolation of uterus and ovaries, duration of surgery, bleeding, wound closure, and healing time as well as to assess the post-operative complications (if any) after spaying in cats.

MATERIALS AND METHODS

The animal experimentation was carried out with the approval and in accordance with the rules and recommendations of the Animal Welfare Experimentation and Ethics Committee (AWEEC) AWEEC/BAU/2022 (27) of the Faculty of Veterinary Science, Bangladesh Agricultural University, Mymensingh.

Experimental animals

Ten local queen cats aged between 8 months to 2.5 years and body weight between 1.5 to 3 kg were randomly selected. All the selected queen cats were carefully examined ultrasonographically to rule out pregnancy and any other uterine disorders. A general health examination was carried out and only the cats with normal body parameters were selected for surgery.

Experimental design

The experimental animals were randomly divided into two groups with 5 animals in each as follows:

Group-A: Cats (n=5) were subjected for spaying through flank approach according to Babu et al. (2018).

Group-B: Cats (n=5) were subjected for spaying by ventral midline approach according to Fingland (1998).

Preoperative patient preparations

In both groups, food, but not drink, was put on hold for 12 hr before to surgery. Normal physiological parameters (heart rate, respiration rate and temperature) were recorded. Surgical area for ventral midline and flank approaches were prepared by clipping the hair and removing the grease, dust by applying soap water. After that, tincture of iodine was used to antiseptis the incision site.

Anaesthetic protocol

All the cats were premedicated with Atropine sulphate (0.04 mg/kg body weight) subcutaneously. Anaesthesia was introduced by combination of Xylazine Hydrochloride (Xyla[®], Interchmie Pharmaceuticals, Holland) 1.1 mg/kg body weight and Ketamine Hydrochloride (Ketalar, Popular Pharmaceuticals, Tongi, Bangladesh) 17 mg/kg body weight intramuscularly.

Surgical procedure

The region that had been cut was cleaned and made aseptic with povidone iodine. With sterile surgical blade No. 11, approximately 1 cm caudal to the umbilicus, a 2-3 cm caudal incision was made in the skin. Allis tissue forceps were used to raise the subcutaneous tissue, and scissors were used to trim it down. A spaying hook was used to externalize the left uterine horn. By moving the index finger caudally while holding the ovary between the thumb and middle finger, strain was applied on the suspensory ligament, and it was steadily increased until the ligament snapped. The first clamp was positioned very next to the ovary, while another clamp was positioned around 5 mm from the first. Between the middle clamp and the ovary, the arteriovenous complex was severed, and a third clamp was placed across the ligament that connects the ovary to the uterine horn. As the proximal clamp was removed, a circumferential ligature made of Vicryl number 0 was tightened, ensuring that it was snug in the groove of crushed tissue left by the clamp. The middle clamp was removed, checked for bleeding, and when the ovarian arteriovenous complex was ligated, the thumb forceps were used to grasp the vessels and pull them into the abdominal cavity. After that, the left uterine horn was located, and similar ligation and transaction techniques were used on the right ovarian arteriovenous complex as on the left. Immediately proximal to the cervix, clamps were placed after exteriorizing the uterine body and cervix. Vicryl number 0 was used to tie off the uterine body and hold it in place. The uterine stump was examined for bleeding once the clamp was released, and it was then inserted back within the abdomen. Following the closure of the abdominal incision, Vicryl number 0 was used to close the linea alba and subcutaneous tissues using a straightforward continuous suture design. Vicryl number 0 was used to seal the skin using an intradermal suture design.

Flank approach

Before the procedure, Tincture of Iodine was used to antiseptis and decontaminates the region. Skin was covered with a sterilized drape that measured about 22 inches. In order to reach the muscle layer, it was spared as an oblique incision that was 2-3 cm in length. The entire left abdomen was then held between the thumb and forefinger after the skin incision, and a small amount of pressure was used to stretch the left abdominal wall. By using light pressure, mosquito artery forceps were guided into the abdominal cavity. The artery forceps' blades were slightly expanded after entering the peritoneum in order to slightly widen the stab incision in muscle and peritoneum. The use of a spay hook allowed the uterus to be externalized. One took hold of the left horn and traced it all the way to the left ovary. The ventral route was used, and an identical procedure for ovary and uterine removal was used. Vicryl number 0 was used to close the muscles and subcutaneous tissues using a straightforward continuous suture pattern. Vicryl number 0 was used to seal the skin using an intradermal suture design.

Post-operative care and management

Antiseptic was applied at the incision site after suturing. Systemic antibiotics, Ceftriaxone (Trizon vet[®], Acme Laboratories Ltd. Dhaka, Bangladesh) was administered at the rate of 12 mg/kg /body weight intramuscularly (IM) to cats to avoid secondary infections. Non-steroidal anti-inflammatory, Ketoprofen (Keto-A- Vet[®], Acme Laboratories Ltd, Dhaka, Bangladesh) was administered IM once daily at the rate of 3 mg/kg body weight for 3 days to reduce inflammation and pain. Antihistaminic, Pheniramine maleate (Astavet[®], Acme Laboratories Ltd; Dhaka Bangladesh) was administered IM once daily at the rate of 1mg/kg body weight for five days. Topical antibiotic ointment was applied twice a day. The skin stitches were removed after healing the wound. Owners were advised to provide soft and small amounts of food to their cats up postoperatively for 2 weeks. Owners were also advised to give Elizabethan collars to their cats.

Post-operative evaluation

To evaluate the best approach for ovariohysterectomy, various parameters such as length of surgical incision, extent of haemorrhage, ease of location and exteriorization of ovaries and uterus, duration of surgery, post-operative complications and time required for complete wound healing were recorded. In addition, the process and nature of wound healing of each group was monitored and compared between experimental groups. The vital signs: heart rate, respiratory rate and temperature were recorded before operation and on 1, 3, 5, 7, 14 and 21 days postoperatively.

Appearance of wound/ gross changes

The clinical appearance of wound was scored at the time 18 to 24 hours and on 3, 5, 7, 14 and 21 days of post-surgery. Wounds were scored based on swelling, dehiscence, and discharge. The scoring system was adopted as suggested by Hoque, (1991).

Statistical analysis

The data were expressed as mean \pm SEM. Independent sample test was performed using SPSS (Statistical package for social science) software to analyze the effect of two approach of ovariohysterectomy. Probability $P < 0.05$ or less was considered as statistically significant.

RESULTS

Clinical parameters

The clinical parameters (heart rate, respiration rate and temperature) of cats during spaying are presented in Table 1. Before anaesthesia, all the parameters were significantly ($P < 0.05$) differed between two groups. The heart rate was higher in group B whereas the respiration rate and temperature were higher in group A compared to group B.

Length of skin incision (cm)

The length of skin incision (cm) in cats those were operated through flank and ventral midline approaches for spaying was almost same. The length of incision in group-A was 2.80 ± 0.56 and the length of incision in group-B was 2.82 ± 0.54 cm (Table 2). The change was not statistically significant ($P > 0.05$).

Exteriorization time of uterus and ovaries

The duration (minutes) of reproductive organs (ovary, uterine horns) exteriorization time in group-A and group-B were recorded and results are presented in Table 2. The average duration of operation was 6.00 ± 1.41 min in group-A and 7.8 ± 1.30 min in group-B and the changes was not statistically significant ($P > 0.05$).

Table 1. Vital signs (heart rate, respiration rate & temperature) recorded during different approaches of spaying in cats (mean \pm SME)

Parameters	Group A (min)	Group B (min)
Heart rate	122.42 ± 27.65^a	135.75 ± 8.67^b
Respiration rate	27.83 ± 3.89^a	25.58 ± 1.86^b
Temperature	100.31 ± 1.15^a	99.35 ± 0.98^b

Table 2. Length of skin incision (cm), exteriorization of ovaries and uterus (min), duration of surgery (min), complete wound healing (day) and extent of haemorrhage in cat of group A (flank approach) and group B (ventral midline approach) (mean \pm SME)

Parameters	Flank approach	Ventral midline approach	P Value
Length of skin incision (cm)	2.80 ± 0.56	2.82 ± 0.54	0.951
Exteriorization of ovaries and uterus (min)	6.00 ± 1.41	7.8 ± 1.30	0.389
Duration of surgery (min)	23.25 ± 4.20	29.25 ± 4.88	0.581
Complete wound healing (days)	13.75 ± 7.85	16.50 ± 1.26	0.182
Extent of haemorrhage	Mild to moderate	Less or no	

Total duration of the operations

The duration of the operation in group A and group B, which are operated through flank and ventral midline approaches, respectively was recorded and results are presented in Table 2. Total operation time in group –A was 23.25±4.20 and 29.25±4.88 min in group- B. The total operation time in group –B is slightly higher than group-A which is not statistically significant ($P>0.05$).

Duration (days) of wound healing

Duration of wound healing (days) in both groups of cats which were operated through flank and midline approaches for ovario-hysterectomy was recorded and results are presented in Table-2. The average wound healing days were 13.75±7.85 in group-A and 16.50±1.26 days in group-B. Duration of wound healing (days) in group –B is slightly higher than group-A which is not statistically significant ($P>0.05$). During Spaying in cats, extent of haemorrhage was mild to moderate in flank approach, whereas it was less to no in ventral midline approach (Table 2).

Gross appearance of the wound

The Gross appearance of the wound like swelling, erythema, dehiscence and discharge in Group-A and Group –B were observed and scored after 18 – 24 hours and on 3, 5, 7, 14, 21 days after surgery, and results are depicted in Table 3. Post- operative complications were higher in the ventral midline method (group –B) than flank method (Group A).

Table 3. Wound appearances/ gross changes during flank approaches and ventral midline approaches of spaying in cats

Time	Groups	Wound color	Swelling/Exudate	Urination	Defaecation	Needle pricking
Day 1	A	Normal		Absent	Absent	
	B	Normal	Present	Absent	Absent	Present
Day 3	A	Reddish	Moderate	Present	Present	Present
	B	Reddish	Present	Present	Present	Present
Day 5	A	Mild red	Moderate	Present	Present	Present
	B	Mild red	Present	Present	Present	Present
Day 7	A	Mild black	Mild	Present	Present	Present
	B	Reddish	Present	Present	Present	Present
Day 14	A	Black	Absent	Present	Present	Absent
	B	Mild red	Present	Present	Present	Present
Day 21	A	Pinkish	Absent	Present	Present	Absent
	B	Pinkish	Absent	Present	Present	Present

Management of post-operative complications

Post-operative clinical examination was performed in all cats at regular intervals to investigate wound healing related complications. In this study, 5 cats were treated with ventral midline approach, among these, one cat showed post-operative complications. On day 5 post-operation, the operation site showed clean and dry. The surgical wounds at the site of operation were free from any complications. But on day 11 post-operation, surgical wound found to be moist and suppurated including wound dehiscence. Observations of surgical wounds continued up to day 28 post surgery and infections progressed badly. Then the wound was washed with normal saline followed by tincture of iodine to remove debris and hasten healing. The cases were also treated with antibiotics for a long period.

DISCUSSION

Ovariohysterectomy was the most popular and preferred method of contraception among medical professionals because it not only controlled the population but also had a seven-fold lower risk of mammary carcinoma and progesterone-mediated mammary hypertrophy (Bloomberg, 1996). The current investigation showed that group B's (ventral midline approach) incisions was longer than those of group A's (flank approach). The same results were also reported by (Coe et al., 2006; Rana, 2007). The flank technique's shorter incision length was chosen because it was simpler and more practical to provide greater localization and accessibility than the midline approach.

A brief abdominal muscle incision was used in the current investigation to perform an ovariohysterectomy, and it was discovered that this method caused mild to moderate bleeding at the surgical site, whereas moderate bleeding was seen at the ventral midline spaying. According to Ghanawanth and Mantri, (1996), exteriorizing the opposing ovary and uterine horn proved challenging from the flank approach. However, in the present study, there were no issues with exteriorizing or ligating the ovarian pedicle and cervix at the flank site. The current study revealed that group A's average operating time was shorter than group B's, although this difference was not statistically significant. The length of skin incision was much shorter in cats performed using the flank approach than the midline, according to another study (Coe et al., 2006; Rana, 2007). However, due to the age and weight of the cats being operated on, the length of the operation was reported to be longer than in the current study. The results of the current investigation concurred with Grint et al. (2006) findings, who stated that cats spayed through the ventral midline experienced longer operations than those operated through the flank. Following ventral midline approach spaying, wound healing was seen to be considerably quicker in flank approach spaying. The outcomes are consistent with those of Rana (2007), who found that the flank approach promoted faster and better wound healing than the ventral midline technique. The wound healing days were divided into three categories (i.e., 7, 8-14, and 14 days) by the author, and it was observed that the flank approach wound healed 50% during the first 7 days and the remaining 50% between days 8 and 14, whereas the ventral midline approach wound healed 16.66% during the first 7 days, 50% between days 8 and 14, and 33.33% in more than 14 days.

Spaying through a left flank incision resulted in fewer post-operative complications, such as wound edema and abnormal discharges, wound infection, etc. from the incisional site as compared to cats spayed through a ventral midline incision (Coe et al., 2006). Cats that experienced spaying using a left flank stab incisional method healed their wounds completely much faster than other cats. The results of the current investigation are consistent with those of Kiani et al. (2014), who reported full wound healing days in the ventral midline and lateral flank methods. As most of such treatments in stray cats are carried out by non-governmental organizations, animals exposed to spaying by a left flank stab incisional method benefit from a much lower cost incurred for surgery, minimum post operational problems, and faster wound healing.

Contrary to our findings (Glerum et al., 2001) contends that the flank approach has a number of potential drawbacks, including the potential for difficulty in removing the entire uterine body, difficulty in recovering from a dropped ovarian pedicle, and potential difficulty in exposing the opposing ovary and uterine bifurcation. In this study, wound appearances were assessed on a few postoperative days (days 1, 3, 5, 7, 14, and 21). Gross alterations were evaluated between the two groups, and both showed wound 28 days discharge. The identical outcomes have been noted by (Roberts et al., 2015). There was usual wound exudation in both groups. Contrary to what we found, increasing intra-abdominal pressure on the organs could also be the root of the higher incidence of discharge (Rana, 2007). The intensity of the pain was assessed by puncturing the incision site with a needle. The current study noticed that group B experienced pain on different days, which could have been brought on by the wound's slow healing efficiency or by seroma, bacterial infection, or bleeding, as reported by Coe et al. (2006).

CONCLUSIONS

When comparing two approaches of spaying in cats, it is found that the average time for exteriorization of ovaries and uterus, duration of surgery and complete wound healing time were shorter in flank method of spaying. Although the length of the skin incision was about the same in both groups, the extent of hemorrhage was less in the ventral midline method than in the flank procedure. Moreover, the post-operative complications, pain management and wound healing process were higher in ventral midline approaches of spaying in cats. For this flank approach is better than ventral midline approach during ovariohysterectomy. However, this data may vary to some extent according to surgeon's expertness, experience or if the surgeon becomes a novice. Finally, further research is necessary to assess the healing process and the changes of haemato-biochemical parameters during spaying of both methods in feline and canine.

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CONFLICT OF INTEREST

The authors declare no conflict of interest.

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