



## Ovariectomy versus Ovariohysterectomy for Elective Sterilization of Female Cats

Bedoor M. Omeran , Ramadan E. Abdel-Wahed, Mahmoud H. El-Kammar, Howiada Abu-Ahmed

Department of Surgery, Faculty of Veterinary Medicine, Alexandria University

### Key words

Ovariectomy,  
Ovariohysterectomy,  
Elective sterilization,  
Female cat

### ABSTRACT:

The purpose of this study was to investigate and evaluate both ovariectomy and ovariohysterectomy, as an important surgical method used for sterilization of the female cats. Ovariohysterectomy and ovariectomy for elective sterilization were performed on 50 healthy female cats related to breeds of Siamese, Persian Turkish angora and Native breeds. The ovarioectomy and ovariohysterectomy operations differ significantly ( $P < 0.01$ ) among the sterilized cats. The number of cats that occur to them ovariohysterectomy (60 %), while, those occur to them ovarioectomy reached to (40 %) from the total number of sterilized cats. Ovariohysterectomy, or Spaying is considered a routine abdominal operation and the best age for cats is before puberty. The procedure is done with the animal under general anesthesia and consists of a small incision in the abdomen for removal of the ovaries and uterus. It could be concluded that, the elective sterilization of female cat could be done by ovarioectomy and/or ovariohysterectomy, which is considered a simple, easy and effective techniques for spay in female cats. Spay of the female cats is an important part of basic cat health care. Spaying at a young age prevents mammary cancer and spaying at any age prevents unwanted kittens, noisy heat cycles, and possibly even urine marking in the house.

Corresponding Author: Bedoor M. Omeran: [dodocatcota@yahoo.com](mailto:dodocatcota@yahoo.com)

### 1. Introduction

Elective sterilization of female dogs and cats is one of the most common procedures performed in veterinary practice and is considered by private veterinary practitioners as one of the most important skills required of new graduates. Spaying pet entails surgical removal of the reproductive organs. In females, these are the ovaries and uterus, and the procedure is called an ovariohysterectomy, or spay. For routine spaying, the best age for dogs and cats is before puberty (Bender, 2012). Spayed animals do not go through heat cycles or produce unwanted puppies or kittens. Cats and dogs have their first heat at 5 to 12 months of age. (White, 2012). Sterilization of female dogs and cats can be accomplished by removing both the ovaries and uterus (ovariohysterectomy) or by removing the ovaries alone (ovariectomy) (AVMA, 2010). Despite the apparent preference for ovariohysterectomy in the United States and Canada, ovariectomy appears to have become the standard of care in many European countries.<sup>7</sup> In addition, with the development of minimally invasive surgical techniques; laparoscopic ovariectomy has gained popularity (Gower and

Mayhew, 2008). Thus, it may be helpful to review the scientific evidence comparing ovariohysterectomy and ovariectomy for elective sterilization of healthy female dogs and cats. Ovariohysterectomy and ovariectomy involve similar surgical techniques, except that the skin and fascia incisions are considerably smaller and located more cranially with ovariectomy, compared with ovariohysterectomy (Peeters and Kirpensteijn 2011). Surgical complication rates associated with ovariohysterectomy in healthy dogs and cats have been reported to range from 6.2% to 20.6%, depending on surgeon experience (Pollari et al., 1996 and Burrow et al., 2005). Most complications are mild and generally consist of incisional inflammation or gastrointestinal tract upset. Incisional complications are more common in larger animals and animals with longer surgery and anesthesia times (Burrow et al., 2005). So the present study was aimed to investigate and evaluate both ovariectomy and ovariohysterectomy, as the most important surgical methods used for sterilization of the female cats.

### 2. MATERIALS and METHODS

The present study was carried out with 50 cats related to breeds of Siamese, Persian, Turkish

angora and Native breeds. They were collected from different locations in Alexandria city and from the clinic of the Faculty of veterinary medicine-Alexandria University. All cases were subjected to through clinical examinations including inspections, pulse rate palpation and body temperature. Fasting the patient from food and water for 8 hours prior to induction of general anesthesia with TELAZOL (tiletamine HCl and zolazepam HCl) (manufacture :Zoites ,manufactured for Fort Dodge animal health ) an initial dosage (4.4 to 5.4 mg/lb. The patients were stable in dorsal recumbency with the limbs are tied to help their stabilization. Shaving of the hair should be used gently, parallel to the skin, then Scrub the skin with chlorhexidine scrub from the prep tray and rinse with water containing dilute chlorhexidine solution until the gross debris has been removed.

### Operation techniques

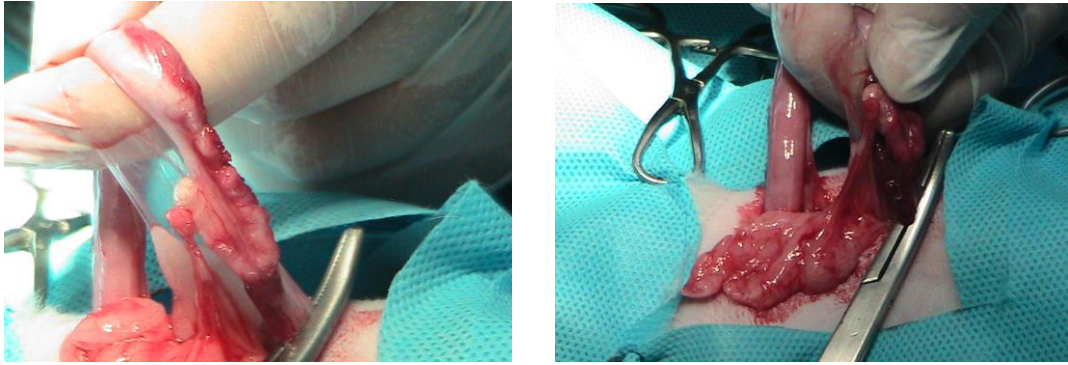
#### Ovariectomy:

A surgical incision is made in the cat's skin (3 cm long) and approximately 1 inch below the umbilical scar on the abdominal midline (Fig., 1). The both ovaries were located through palpation or visualization of the fallopian tubes of the female cats. The feline ovary is usually more conspicuous than the canine. Sweeping the abdomen caudal to a kidney with a spay hook may allow you to snare the uterine horn. The ovary, suspensory ligament, and tip of the uterus were identified and visualized (Fig.,

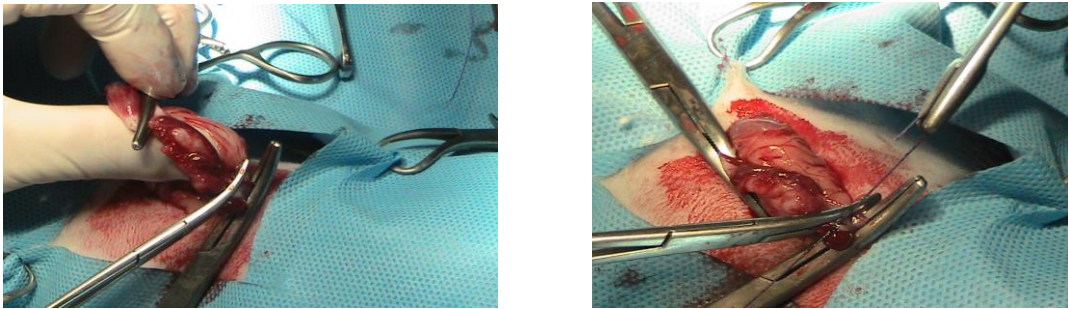
2). The ovary is exteriorized by apply hemostatic forceps to the proper ligament to maintain traction and isolated (Fig., 3). Inspect the mesovarium as a thin relatively avascular area located caudal to the ovarian vascular plexus for fenestration. Cats may have more utero-ovarian venous anastomoses, which could complicate finding such a location. Once an appropriate site in the mesovarium is selected, fenestrate it and pass absorbable suture material through the fenestration (Fig., 4). A hemostat carrying suture has passed through the fenestration in the mesovarium. The ligature will then encompass the ovarian pedicle. Inspect the pedicle to ensure that the ligature will be placed adequately proximal to the mesosalpinx-enclosed ovary. Then tighten and securely knot the ligature around the ovarian pedicle and then cutting of the ligated ovary (Fig., 5 and 6). Next, pass a ligature through the window and allow it to encircle the tip of the uterine horn about 1 to 3 cm caudal to the proper ligament. Check it for proper placement, and then securely tightened and tied. Pass a second ligature, if needed. Place two forceps across the ovarian pedicle between the ovary and the ligatures, and place two forceps across the proper ligament and uterine horn tip. Removal of the forceps while gently grasping the ligated structure and checking for adequate hemostasis. The ovariectomy was done in the opposite ovary similarly. Before closing and suturing, examine for any hemorrhage (Fig., 7).



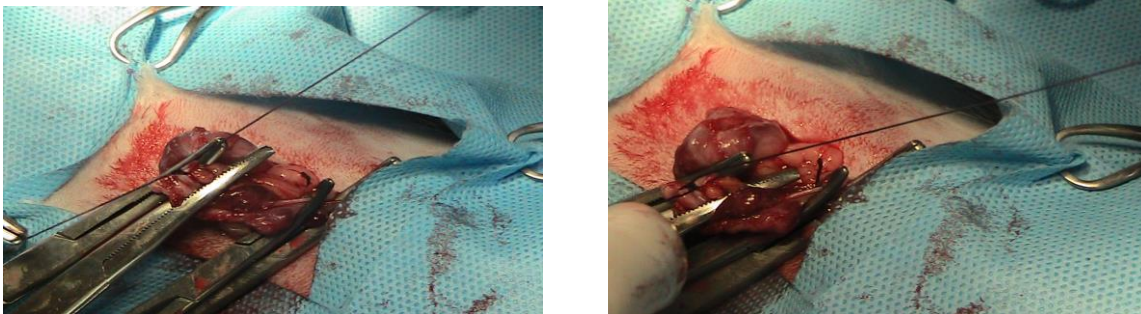
Fig. (1): showing surgical incision is made in the cat's skin (3 cm long) and approximately 1 inch below the umbilical scar on the abdominal midline.



**Fig. (2):** showing both ovaries were located through palpation or visualization of the fallopian tubes of the female cats. The ovary, suspensory ligament, and tip of the uterus were identified and visualized.



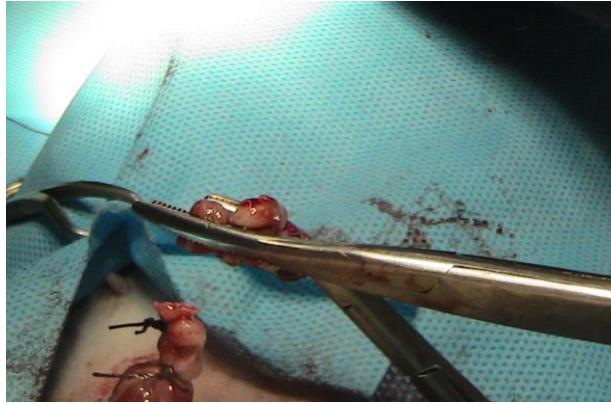
**Fig. (3):** Showing exteriorization of the ovary by applying hemostatic forceps to the proper ligament to maintain traction and isolated.



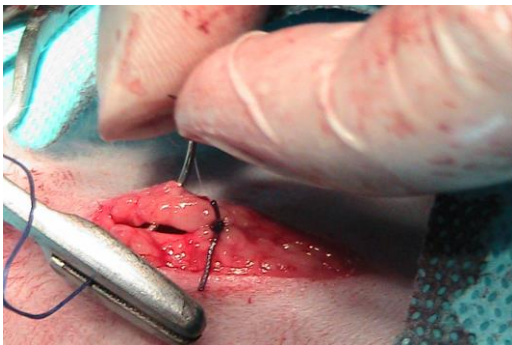
**Fig. (4):** showing the mesovarium selected, fenestrate it and pass absorbable suture material through the fenestration



**Fig. (5):** showing isolation and ligation of the ovary, ovarian Ligament and the ovarian blood vessels before cutting



**Fig. (6):** Showing cutting of ligated ovary



**Fig. (7):** showing suturing of the subcutaneous tissue and the skin

#### **Ovariohysterectomy:**

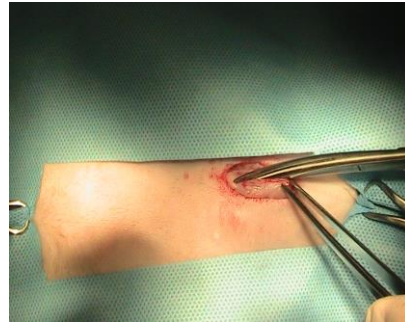
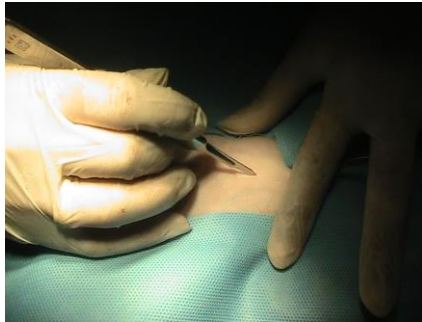
Spay incisions are generally made midway between the umbilicus and pubis to allow ligation of the uterine body. The incision was done through the skin and subcutaneous tissues to expose the linea alba

(Fig., 8). Pick up the loose fascia and fat that covers the external rectus sheath this will expose the bright white fibers of the external rectus sheath. With the cutting surface of the number 10 scalpel blade facing up, use the point of the scalpel to stab through the linea alba (Fig., 9). This should be done about 0.5 cm away from the toothed forceps which are holding the linea in a tented position. Once a small hole has been made through the linea alba into the abdomen, the incision can be extended using either scissors or a guarded scalpel. Slide Spay Hook against the abdominal wall 2-3cm caudal to the kidney then turn the hook medially to ensnare the uterine horn, broad ligament and gently elevate it from the abdomen.(anatomically confirm the identification of the uterine horn by following it either the uterine bifurcation or ovary) (Fig., 10). With caudal and medial traction on the uterine horn identify the suspensory ligament by palpation as the taut fibrous band at the proximal edge of the ovarian pedicle. Break the suspensory ligament near the kidney without tearing the ovarian vessels to allow

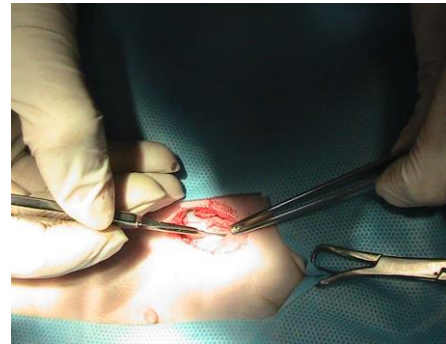
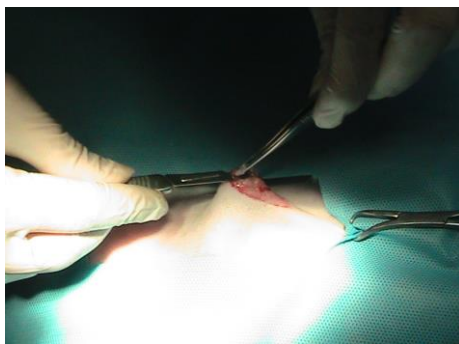
exteriorization of the ovary. Make a hole in the broad ligament caudal to ovarian pedicle then place one or two forceps across the ovarian pedicle proximal to the ovary and one across the proper ligament (the middle clamp holds the pedicle for ligation and the distal clamp prevents backflow of blood after transaction) (Fig., 11). when using two clamps the ovarian pedicle clamp serves both to hold the pedicle and make a groove for ligature. By using polyglyconate suture material 2-0 for ligature (vicryl) begin by directing the blunt end of the needle through the middle of the pedicle loop the suture around one side of the pedicle then redirect the needle through the original hole from the same direction and loop the ligature around the other half of the pedicle, securely tie the ligature. Remove one clamp or flash a single clamp while tightening the ligature to allow pedicle compression. Place a second circumferential ligature below the first one to control the hemorrhage which may occur from puncturing a vessel as the needle is passed through the pedicle. Place a mosquito hemostat on the suspensory ligament near the ovary, transect the ovarian pedicle between the forceps and ovary (Fig., 11). Remove the forceps from the ovarian pedicle and observe for hemorrhage, replace the forceps and religate the pedicle if hemorrhage is noted. Grasp the other uterine horn and follow it to the opposite

ovary then place the forceps and ligature as the another one. Put the forceps across the uterine body then apply cranial traction on the uterus and ligate the uterine body cranial to the cervix ,by using point of the needle make encircling suture through the body, place circumferential ligature near the cervix(Fig., 12). Grasp the uterine wall with forceps or mosquito hemostats cranial to ligature. Transect

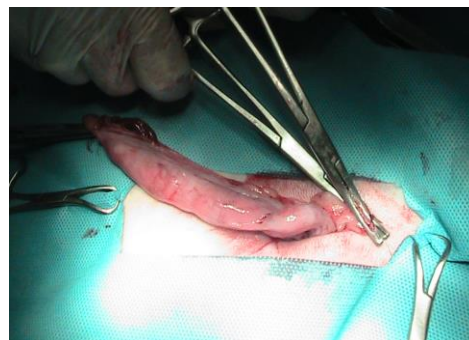
the uterine body and observe for hemorrhage (religate if there are hemorrhage). Replace the uterine stump into the abdomen before releasing the hemostate or forceps (Fig., 13&14). Closure the abdomen and skin by simple interrupted , using vicryl 2/0 (manufactured:ETHICON)



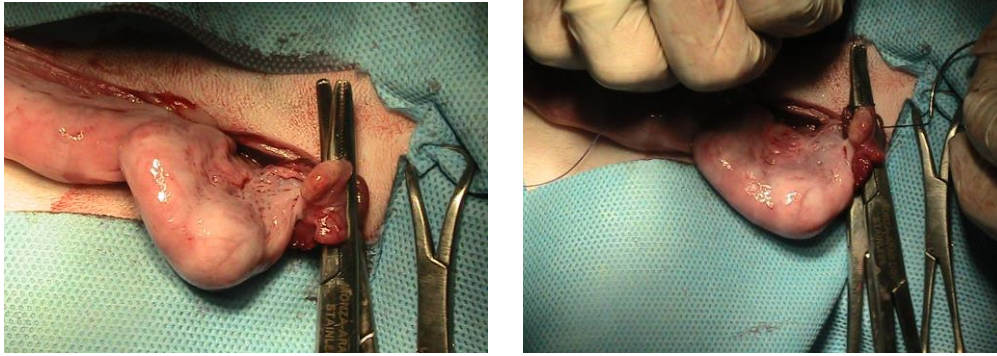
**Fig. (8):** showing Spay incisions are generally made midway between the umbilicus and pubis the incision was done through the skin and subcutaneous tissues



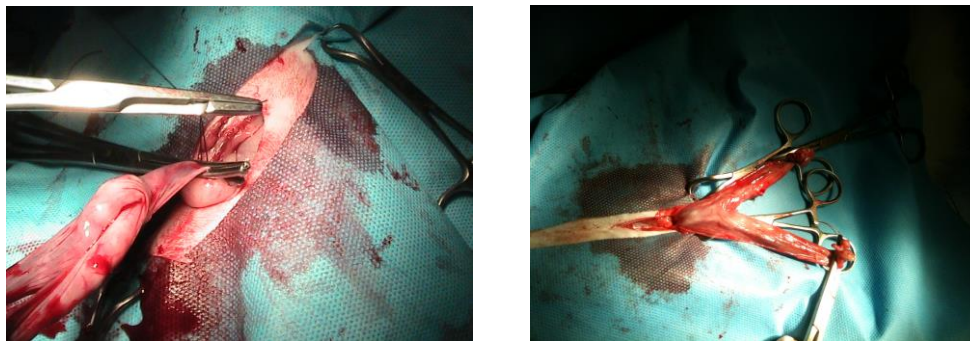
**Fig. (9):** showing incision in the loose fascia and fat that covers the external rectus Sheath. The linea alba is at the confluence of these fibers then grasp the linea alba with toothed forceps and tent the body wall as much as possible.



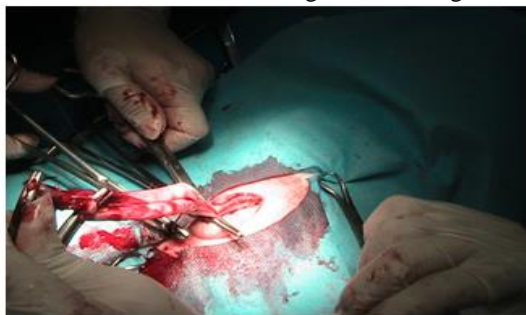
**Fig. (10):** showing a Slide Spay Hook against the abdominal wall 2-3cm caudal to the kidney then turn the hook medially to catch and snared the uterine horn, broad ligament and gently elevate it from the abdomen



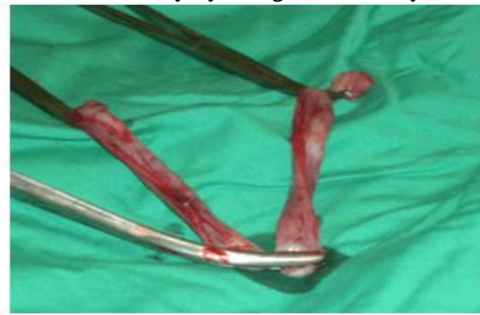
**Fig. (11):** showing exteriorization and ligation of the ovary after caudal and medial traction on the uterine horn and identification of the suspensory ligament by palpation at the proximal edge of the ovarian pedicle without tearing the ovarian vessels.



**Fig. (12):** Showing clamping of the uterine body cranial to the cervix ,by using point of the needle make encircling suture through the body, place circumferential ligature near the cervix, grasp the uterine wall with forceps or mosquito hemostats cranial to ligature and transect the uterine body and observe for hemorrhage (religate if hemorrhage is observed) after transection of the ovarian ligament and ligation of the uterine body by using coated vicryl no 2.



**Fig. (13):** Showing cutting and removal of the uterine body cranial to the cervix by using scalpel.



**Fig. (14):** Showing reproductive tract after removal. Note the uterus as two horns forming a Y shape. The ovaries are located at the end of the arms of the Y. The cervix is at the base of the Y.

### 3. RESULTS

#### **Sterilization among cat species and fate of female cat after sterilization:**

##### **a- Number of cat that occur to them sterilization:**

The data presented in Table (1) cleared that the cats that occur to them sterilization differ among different species ( $P < 0.01$ ). The total numbers of cats were 50. The Siamese cat constituted about (26

%), Persian cats (30 %), Angora (24 %) and native cats reached to (20 %).

**b-Ovarioectomy and Ovariohysterectomy in sterilized female cats:** The results cleared in Table (2) indicated that, the ovarioectomy and ovariohysterectomy operations differ significantly ( $P < 0.01$ ) among the sterilized cats. The number of cats that ovariohysterectomy was performed (60 %), while, those with ovarioectomy reached to (40 %) from the total number of sterilized cats.

**Table (1): Number of cat species occurred to them sterilization:**

Type of female cat species	Number	%
Siamese	13	26
Persian Turkish	15	30
Angora	12	24
Native	10	20
Total	50	100

**Table (2): Number of sterilized female cat and type of operation.**

Type of operation	Number	%
Ovariectomy	20	40
Ovariohysterectomy	30	60
Total	50	100

**c-Number of a lived female cats after Ovariectomy and ovariohysterectomy:** The results cleared in Table (3) indicated that, the cats that sterilized by either ovariectomy or ovariohysterectomy operations were a live and no case dead during and after operation of sterilization.

**Effect of cat sterilization on hormone level before and after operation:**

**a-Effect of sterilization on progesterone hormone level:** As present in the Table (4) cleared the significant (  $P < 0.01$ ) differences of the level of progesterone before and after sterilization. As the progesterone level decreased after sterilization than that before sterilization this attributed to the removal of ovaries.

**b-Effect of sterilization on estrogen hormone level.** Table (5) cleared the significant (  $P < 0.01$ ) differences of the level of estrogen before and after sterilization. As the estrogen level decreased severely after sterilization than that before sterilization this attributed to the removal of ovaries

**4. DISCUSSION**

Ovariohysterectomy, or Spaying is considered a routine abdominal operation and the best age for cats is before puberty. The procedure is done with the animal under general anesthesia and consists of a small incision in the abdomen for removal of the ovaries and uterus.

Recovery is generally prompt. Most cats can go home the day after surgery and are back to normal within five to seven days. The same results were obtained by (Davidson et al., 2004 and Brooks, 2014). Spaying cat is an important part of basic cat health care. Spaying at a young age prevents mammary cancer and spaying at any age prevents unwanted kittens, noisy heat cycles, and possibly even urine marking in the house. We have found that even though the cat spay is a routine and a commonly performed procedure, many pet owners still have questions (Okkens et al., 1997 and DeTora and McCarthy, 2011). The present results agreed with those of (Burrow et al., 2005) where they reported that, the sterilizing cat operation is a simple and easy operation and can occur to the large number of cats in the same times. Also, our results cleared that, all breeds of cats that found in Egypt as native breeds or foreign breeds as Siamese, Persian, Angora or other breeds can occur to it sterilization successfully. (Berzon, 1979 and Ball et al., 2010). The results of the present study cleared that, for sterilization it is best to make an ovariohysterectomy than the ovariectomy. Our results agreed with those of Brodey (1967); Janssens and Janssens, (1991); Spain et al., (2004); Kustritz (2007) and Brooks (2014) who reported that, spay is an ovariohysterectomy, which means that both the ovaries and the uterus are removed. The cervix is tied off, leaving the vagina to end in a blind sac. Since it is the ovaries that are responsible for the.

**Table (3): Fate of the female cats after sterilization.**

Type of operation	Total number of cat sterilized	Live cat		Dead cat	
		Number	%	Number	%
Ovariectomy	20	20	100	0	0
Ovariohysterectomy	30	30	100	0	0
Total	50	50	100	0	0

$\text{Chi}^2 = 6.25^{**}$

\*\* = Significant at ( $P < 0.01$ )

**Table (4): Level of progesterone before and after sterilization.**

Time	Number of cats	Progesterone	t-value
Before sterilization	50	0.09±0.001A	5.56
After sterilization	50	0.03±0.001B	

\*\* Means within the same column of different litters are significantly different at (P < 0.01)

**Table (5): Level of estrogen before and after sterilization.**

Time	Number of cats	Estrogen	t-value
Before sterilization	50	17.41±3.55A	9.55
After sterilization	50	11.42±2.331B	

\*\* Means within the same column of different litters are significantly different at (P < 0.01)

heat cycles, possible mammary tumor development, and behavior problems, it is crucial that the ovaries be removed intact (Okkens et al., 1981a; Okkens et al., 1981 b ; Miller, 1995 and Klein et al., 2007). The present results indicated that cat sterilization by ovarioectomy and ovariectomy is a simple and easy operation and not take a long time and the cat take a rest period of 2-3 day till the stitches absorbed. Our results agreed with those of DeTora and McCarthy (2011) and Brooks (2014) who reported that, the hospital prefers to keep surgery cases over night so that they can have “bed rest” in a properly confined area. Where he believes that this first night of confinement helps the incision in healing. Some hospitals and most spay clinics will release the cat on the same day as surgery so that she may be observed at home in case of problems. Skin stitches necessitate a return visit for a recheck, which is always a good idea after an abdominal surgery (Ortega-Pacheco et al., 2007 and Reichler et al., 2009). The present results cleared that, the best time of carrying sterilizing in cats after end of the heat period , to avoid the engorgement of the blood vessels of the genital tracts with the blood that occur during the heat period. This results agreed with those of (Brooks, 2014), who they found that, some female cats are disruptively annoying when they are in heat, yowling and carrying on, and they are spayed to end the heat quickly. The present cleared that, the place in which the sterilization of the cat is performed must be clean and equipped with different surgical instruments to avoid any risk to the cat. Our results agreed with those of (Greenfield et al., 2004 and Brooks, 2014), where they reported that, the place of sterilizing cats may have a very regional answer depending on what sort of low cost facilities are available in a given area. Most areas have some sort of low cost spay/neuter option (consult your local animal shelter for more information). The results of hormonal analysis before and after sterilization cleared the decrease of

the level of progesterone and estrogen in the cat serum and this reflected on the calm and rest conditions that appeared on the cats after sterilization as the two hormones (estrogen) is responsible for estrous signs and restless conditions that appeared on the cat and also the signs of pregnancy that appear on the cat due to progesterone hormone. Our results agreed with those of (Stone 2003 and Brooks, 2014) where he reported that, the female cat spends at least half the year with her reproductive tract dormant (cats only cycle seasonally, primarily in the spring and summer). Our results agreed with those of (Van Goethem et al., 2006 and Brooks, 2014) , where they reported that, the traditional age for spaying is six months; however, this practice has enabled kittens to be adopted from the shelters unspayed. Often the new owner fails to return for spaying and the result is further contribution to the pet over-population problem. The last 20 years has brought us a great deal of research into “early” spaying and we now know that there is no problem with spaying as early as 8 weeks of age. Our hospital finds such tiny tissues difficult to manipulate and we like to spay our female patients when they weigh at least 3 1/2 to 4 pounds. (Verstegen et al., 2008).

### 5. Conclusion

It could be concluded that, the elective sterilization of female cat could be done by ovarioectomy and/or ovariectomy, which is considered a simple, easy and effective techniques for spay in female cats. Spay of the female cats is an important part of basic cat health care. Spaying at a young age prevents mammary cancer and spaying at any age prevents unwanted kittens, noisy heat cycles, and possibly even urine marking in the house.

### 6. REFERENCES

- AVMA. 2010. Educational Commission for Foreign Veterinary Graduates. Clinical proficiency examination instructors guidelines. Schaumburg, III: AVMA.



- Ball, R.L., Birchard, S.J., May, L.R. 2010. Ovarian remnant syndrome in dogs and cats: 21 cases (2000–2007). *J. Am. Vet. Med. Assoc.* 236:548–553.
- Bender, W.M., 2012. Ovariectomy versus ovariohysterectomy. *J. Am. Vet. Med. Assoc.* 240(6): 659-660.
- Berzon, J.L. 1967. Complications of elective ovariohysterectomies in the dog and the cat at a teaching institution: clinical review of 853 cases. *Vet. Surg.* 8: 89–91.
- Brodey, R.S., Roszel, J.F. Neoplasms of the canine uterus, vagina and vulva: a clinicopathologic survey of 90 cases. *J. Am. Vet. Med. Assoc.* 151: 1294–1307.
- Brooks, W. C. 2014. *Feline Spay FAQ*. The pet health library. Copyright Veterinary Information Network, Inc.
- Burrow, R., Batchelor, D. Cripps, P., 2005. Complications observed during and after ovariohysterectomy of 142 bitches at a veterinary teaching hospital. *Vet. Rec.* 157: 829–833.
- Davidson, E.B., Moll, H.D., Payton, M.E. 2004. Comparison of laparoscopic ovariohysterectomy and ovariohysterectomy in dogs. *Vet. Surg.* 33: 62–69.
- DeTora, M., McCarthy, R. J. 2011. Ovariohysterectomy versus ovariectomy for elective sterilization of female dogs and cats: is removal of the uterus necessary? *JAVMA.* 239: 110.
- Gower S, Mayhew, P. 2008. Canine laparoscopic and laparoscopic-assisted ovariohysterectomy and ovariectomy. *Compend Contin Educ Pract Vet.* 30: 430–440.
- Greenfield, C.L., Johnson, A.L., Schaeffer, D.J. 2004. Frequency of use of various procedures, skills, and areas of knowledge among veterinarians in private small animal exclusive or predominant practice and proficiency expected of new veterinary school graduates. *J. Am. Vet. Med. Assoc.* 224: 1780–1787.
- Janssens, L.A., Janssens, G.H. 1991. Bilateral flank ovariectomy in the dog—surgical technique and sequelae in 72 animals. *J. Small Anim. Pract.* 32: 249–252.
- Klein, M.K., 2007. Tumors of the female reproductive system. In: Withrow S, Vail D, eds. *Small animal clinical oncology*. 4th ed. St Louis: Elsevier Science; 613–614.
- Kustritz, M., 2007. Determining the optimal age for gonadectomy of dogs and cats. *J. Am. Vet. Med. Assoc.* 231:1665–1675.
- Miller, D.M.1995. Ovarian remnant syndrome in dogs and cats: 46 cases (1988–1992). *J. Vet. Diagn. Invest.* 7:572–574.
- Okkens, A.C., Dieleman, S.J., van, de Gaag, I., 1981b. Gynaecological complications following ovariohysterectomy in dogs, due to: (1) partial removal of the ovaries. (2) inflammation of the uterocervical stump [in Dutch]. *Tijdschr Diergeneeskd*; 106:1142–1158.
- Okkens, A.C., Kooistra, H.S., Nickel, R.F. 1997. Comparison of long-term effects of ovariectomy versus ovariohysterectomy in bitches. *J. Reprod. Fertil.* 51: 227–231.
- Okkens, A.C., van de Gaag, I., Biewenga ,W.J. 1981. Urological complications following ovariohysterectomy in dogs [in Dutch]. *Tijdschr Diergeneeskd*; 106:1189–1198.
- Ortega-Pacheco, A., Segura-Correa, J.C., Jimenez-Coello, M., 2007. Reproductive patterns and reproductive pathologies of stray bitches in the tropics. *Theriogenol.*; 67: 382–390.
- Peeters, M.E., Kirpensteijn, J. 2011. Comparison of surgical variables and short-term postoperative complications in healthy dogs undergoing ovariohysterectomy or ovariectomy. *J. Am. Vet. Med. Assoc.* 238: 189–194.
- Pollari, F.L., Bonnett, B.N., Bamsey, S.C. 1996. Postoperative complications of elective surgeries in dogs and cats determined by examining electronic and paper medical records. *J. Am. Vet. Med. Assoc.* 208:1882–1886.
- Reichler, I.M. 2009. Gonadectomy in cats and dogs: a review of risks and benefits. *Reprod. Dom. Anim*; 44:29–35.
- Spain, C.V., Scarlett, J.M., Houpt, K.A.,2004. Long-term risks and benefits of early-age gonadectomy in dogs. *J. Am. Vet. Med. Assoc.* 224: 380–387.
- Stone, E.A. 2003. Ovary and uterus. In: Slatter D, ed. *Textbook of small animal surgery*. 3rd ed. Philadelphia: Elsevier Science.; 1487–1496.
- Van Goethem, B, Schaeffers-Okkens A, Kirpensteijn J,2006. Making a rational choice between ovariectomy and ovariohysterectomy in the dog: a discussion of the benefits of either technique. *Vet Surg.*35:136–143.
- Verstegen J, Dhaliwal G, Verstegen-Onclin K,2008. Mucometra, cystic endometrial hyperplasia, and pyometra in the bitch: advances in treatment and assessment of future reproductive success. *Theriogenology*; 70: 364–374.
- White, S.C., 2012. Prevention of fetal suffering during ovariohysterectomy of pregnant animals. *J. Am. Vet. Med. Assoc.* 240(10):1160-1163.