

Some Studies on Feline Genital System Surgical Affections (Prevalence, Histopathology and Surgical Interventions)

¹Nasser A. Senna, ¹Haithem A. Farghali and ²Reda K.I. Shalaby

¹Department of Surgery, Anesthesiology and Radiology,
Faculty of Veterinary Medicine, Cairo University, Giza, Egypt

²Tanta Pet Animals Clinic, Tanta, Egypt

Abstract: The present study was conducted over a period of 2 years on 1345 cats suffered from different affections. Cats were collected from the Surgery Clinic of Faculty of Veterinary Medicine, Cairo University and different pet clinics at Tanta and Cairo governorates. The ages of the affected cats were ranging from two months to 15 years old and they were of different breeds and sex. Surgical affections of the genital system were recorded in 113 cats (8.5% out of total admitted cats). The incidence of genital system affection was higher in queen cats (13.2%) than tom cats (2.7%). The highest incidence of surgical affections in male genital system was recorded as testicular affections (82.4%) followed by penile affections (17.6%). Cryptorchidism was recorded in 70.6% from the total affected tom cats. The highest incidence of surgical affections in female genital system was recorded as uterine affections (88.5%) and mammary gland affections (11.5%). Regarding the uterine affection, the highest incidence of uterine affection was recorded as pyometra (54.2%). The most common surgical affection of the mammary gland in queen cats was mammary neoplasm, representing 11.5%. Diagnosis of mammary gland tumors was depended mainly on physical and Ultrasonographic examinations. It was concluded that surgical affections of genital system represent a considerable incidence among total surgical affection in both tom and queen cats. Cryptorchidism and pyometra are the most detected genital affections in tom and queen cats, respectively.

Key words: Feline • Genital System • Surgical Affections

INTRODUCTION

Cats were loved, venerated, sacred and deified in Ancient Egypt. They dedicated to one of Egypt's most powerful deities-the goddess Bastet; Bassett or Bast. This goddess is a symbol of fecundity and beauty, which depicted with the head of a cat and a mysterious, bewitching glance. Egyptians believed that it could be the fertility of man and cure illness while male cat was regarded a sacred to the potent sun god (Ra). Dead cats were mummified and buried in special cemeteries. Over 300.000 cat mummies were uncovered in 1890 from one of the Ancient capitals of Egypt [1, 2].

Classifications of genital system affections in male cats were tabulated by some authors [3-5]. Moreover,

some literature were published dealing with surgical affections of female genital system in cats [6-10].

Milis *et al.* [11], Scott *et al.* [12] and Ronald [13] reported that cryptorchidism is a rare condition in cats, the incidence in cats was ranging from 0.4 - 2 %. Most cryptorchid cats present with an inguinal ectopia.

Johnston *et al.* [14], Knighton [15] and Johnson [16] found that a variety of congenital disorders results in testicular hypoplasia or hypogonadism. These affections were recognized in young animals as they reach puberty. Determination of the specific cause of testicular hypoplasia in an individual animal was needed. Testicular histopathology may be normal in some areas; some or all seminiferous tubules without spermatogonia; or, some or all tubules with Sertoli cells only.

Lysimachos *et al.* [17], Fossum [18] and Autumn *et al.* [19] reported that phimosis is a congenital or acquired condition (Neoplasia, infection, inflammation, edema and C.T. formation), in which the preputial orifice was absent or too small to allow extrusion of the penis.

Scott *et al.* [12] and Stanley and Pacchiana [20] reported that Pyometra in cats is not common, 12 of three thousand (0.4%) adult free-roaming females were found having pyometra in a trap-neuter-return program was a disease that was mainly characterized by progesterone-induced hyperplasia of the endometrium, cystic dilatation of the endometrial glands and inflammation of the uterus, with purulent contents in the uterine lumen leading to several clinical signs.

Benesch and Wright [21], Slatter [22], Ozyurtlu and Kaya [23], Fossum *et al.* [24], Dipanjan Chakraborty *et al.* [25] and Crane and Kutzler [26] stated that uterine prolapse was associated with parturition during prolonged labour or up to 48 hours after parturition with incidence of less than 0.03%. Bilateral uterine prolapse occurrence was very much rare and usually happened when both uterine horns emptied after parturition. The actual cause of uterine prolapse was unknown but it might be due to excessive relaxation and stretching of pelvic musculature, incomplete placental membrane separation, severe tenesmus, uterine disease, rough handling during parturition. Diagnose was achieved by visual observation and digital palpation. Treatment by manual reduction and reposition of everted uterus is generally impossible in bitch therefore under general OH is indicated.

Stanley and Pacchiana [20], Jackson [27], Raut *et al.* [28], Barrand [29] and Kumru *et al.* [30] reported that uterine torsion is an uncommon, but life-threatening condition in the bitch and queen. The occurrence of the disorder was higher in the gravid than non-gravid uterus. Unilateral torsion was more likely to occur than bilateral. Suggested causes of uterine torsion include jumping, running or rolling behaviour during excessive play, premature uterine contraction in late pregnancy, foetal physical activities, partial abortion, hereditary weakness or variations in length and mobility of the proper ovarian and uterine ligaments and the use of oxytocin. The reported cases were commonly associated with abnormal uterine distension such as haematometra.

Misdorp and van der Heul [31], Sanchez *et al.* [32], Amorim *et al.* [33], Mcaloose *et al.* [34], Pliego *et al.* [35] and Fusaro *et al.* [36] reported that in cats, the mammary neoplasias (Carcinoma) were the third most frequent, after the cutaneous tumors and the lymphoma. The mammary tumors represented 12% of them.

The aim of the present work was to study prevalence, histopathology and surgical interventions of the most common surgical affections of genital system in cats.

MATERIALS AND METHODS

This study was conducted over a period starting from September, 2013 until January, 2015. The affected cats were collected from the Surgery Clinic of Faculty of Veterinary Medicine, Cairo University and different pet clinics at Tanta and Cairo governorates.

The total number of examined cats was 1345 showing different affections. The ages of the affected cats were ranging from two months to 15 years old and they were of different breeds and sex.

To collect the required data, examination sheets was designed. Each affected cat was thoroughly examined and all collected data were put on record. To confirm preliminary diagnosis, some diagnostic investigations were carried out. These investigations included, radiological imaging, ultrasound scanning, laboratory investigations, microbiological examination and histopathological examination.

Radiological examination was done using X-ray unit at Department of Surgery, Anesthesiology Cairo University (Fischer, Japan) and private pet clinics (Prima, Fuji, Japan) for diagnosis.

Ultrasonographic scanning was done at Department of Surgery, Anesthesiology and Radiology, Cairo University (Toshiba, Japan) as well as at different pet clinics (Belson and Mindray, China).

For laboratory investigations, blood samples were taken under sedation with Xylazine Hcl (1mg/kg B.W. I/M or S/C) by vein-puncture of cephalic or recurrent tarsal vein. Two samples were obtained from each animal. One on anticoagulant and the other without anticoagulant for collecting serum. Packed cell volume (P.C.V %), hemoglobin (Hb %), red blood cells, white blood cells and differential leucocytes count were made according to Keer [37]. Serum was obtained from the clotted blood after incubation at 37°C for half an hour and centrifugation at 3000 r.p.m for ten minutes. Using commercial ELISA kits, the obtained non-hemolytic clear serum samples were submitted to determination of testosterone, progesterone and Estradiol 17 β [38].

Bacteriological samples were taken by aspiration with sterile syringes and sterile cotton swabs. These bacteriological materials were subjected to culturing on enriched Medias (Nutrient broth, Nutrient agar,

MacConkey agar, Eosin methylene blue agar and Brilliant green agar). The inhibition zones of different antibiotics were recorded [39].

The histological specimens collected from operated cases were fixed in 10% neutral buffered formalin. The formalin –fixed tissue samples were processed routinely for paraffin embedding technique, sectioned at 4 μ m and stained with haematoxylin and eosin (H. & E.). The stained sections were examined by light microscope and photographed [40].

Surgical interventions were tried in some cases using the suitable standard techniques.

Data were collected, tabulated as percentages.

RESULTS

In the present study examination of 1345 cats suffered from different affections revealed that out of them, 113 cats suffered from genital system surgical affections representing 8.5%. Table 1 shows the total examined animals in different locations.

Seventeen tom cats suffered from genital surgical affections, represented 14.9% out of the total affection of the genital system in cats. Testicular (14) and penile (3) affection were diagnosed.

Ten tom cats suffered from unilateral cryptorchidism and two from subcutaneous ectopic testes.

Cryptorchidism of the right testicle (Nine) was more frequent than the left one (Three). Ultrasounds findings revealed as hypoechoic testicle with hyperechoic rete testis at the mid of the testicle and the size was 1.8×0.6cm. The testicle was located under the neck of the urinary bladder. In ectopic testicle, Ultrasounds revealed homogenous hypoechoic testis with hyperechoic rete testis and testicular capsule. The size of the affected testis was 1.8×0.9cm (Fig. 1).

Hormonal assay for tom cats suffered from cryptorchidism revealed that Testosterone level was ranging between 1.3 - 3.2 ng/ml, Estradiol 17 β level was Less than 10pg/ml.

Histopathological findings of ectopic testis showed that most seminiferous tubules composed of Sertoli cells only which were separated from its basement membrane. Some seminiferous tubules had proliferation of its Sertoli cells lining indicating Sertoli cell tumor.

Unilateral and bilateral testicular hypoplasia was recorded in two cats (Fig. 2). Laboratory findings revealed that testosterone level was 3.5ng/ml.

Penile necrosis/ gangrene and phimosis were diagnosed in three affected tom cats. Penile necrosis or/ gangrene was recorded in (Two) tom Persian cats as complications for urine retention. Surgical amputation of penis and urethrostomy was performed (Fig. 3). The results were satisfactory. Clinically, tom cat with phimosis presented by inability to protrude penis due to mechanical effect of hair which made circular black around the tip of penis. The hair follicle was removed (Table 2 and Fig. 4).

In the present study, ninety six queen cats were found to suffer from genital surgical affection, represented 84.2% of the total genital system affections in cats. The affections included uterine (85 cats) and mammary gland (11 cats) affections. The diagnosed surgical affections of the cat's uterus were pyometra, uterine prolapse and uterine torsion (Table 3) and (Fig. 4).

The mean age of queen cats affected with pyometra was 2.6 years old. Their breeds was (30) Persian cats, (13) Siamese short- hair cats and (9). Two types of pyometra were diagnosed, open pyometra (33 cats) and closed pyometra (19 cats). History of cats with closed pyometra revealed that they received contraceptive drugs. The affected female cats with open pyometra suffered from purulent vaginal discharge, depression, anorexia, thirst, sporadic vomiting and high temperature (Mean= 40.5°C) then decreased to 38°C. Queen cats with closed pyometra clinically showed enlarged drooped abdomen, dehydration, anorexia and their mean temperature was 38.4°C then in the later (37°C).

Radiological examination of cats with pyometra showed sausage- like fluid filled tubular organ located between the descending colon and urinary bladder. Ultrasonographic findings as hyperechoic thickened wall with intraluminal trabiculi and anechoic content of the right uterine horn and in another case as hyperechoic wall and anechoic large amount contents with hyperechoic dots indicated floating flanks and cellular elements (Fig. 5).

In five queen cats suffered from open pyometra, WBCs count (Mean= 16.4thousand/cmm), mild normocytic, normochromic non-degenerative anemia (Hb= 11.5%), PCV (33%). Hormonal assay of five female cats with open pyometra were revealed that, progesterone hormone (3ng/ml) and Estradiol 17 β (35pg/ml). Hormonal assay for five female cats affected with closed pyometra showed progesterone (7ng/ml) and Estradiol 17 β (20pg/ml). Bacteriological findings of (17) affected female cats revealed presence of *E. coli* in (11) cases, staphylococcus Spp in (Two) cats, streptococcus in (Three) cases and proteus spp. in (One) case.

Table 1: Locations of the total admitted and genital system affected cases and their percentages over a period starting from September 2013 until January 2015

Locations		Cats			
		Male	Female	Other	Total
Surgery Clinic Faculty Vet. Med. Cairo Uni.	Total admitted cases	287	242	-	529
	Genital system affected cases	2	13	-	15
	Percentage	0.7%	5.4%	-	2.8%
Clinic in Gharbia governorate	Total admitted cases	190	247	1	438
	Genital system affected cases	7	57	1	65
	Percentage	3.7%	23.1%	100%	14.8%
Clinic in Cairo governorate	Total admitted cases	143	236	-	379
	Genital system affected cases	8	26	-	34
	Percentage	5.6%	11%	-	9%
Total	Total admitted cases	620	725	1	1345
	Genital system affected cases	17	96	1	113
	Percentage	2.7%	13.2%	100%	8.5%

Table 2: Surgical genital affections in tom cats

Affected organs	Number of affected animals	% to the total affected male cats (17)	% to the total affected cats (113)	Surgical affections	Number	% to the regional affected no. cats	% to the affected males (17)	% to the total affected cats (113)
Testicular affections	14	82.4%	12.3%	Cryptorchidism	12	85.7%	70.6%	10.6%
				Testicular hypoplasia	2	14.3%	11.8%	1.8%
				Penile necrosis / gangrene	2	66.7%	11.8%	1.7%
Penile affections	3	17.6%	2.6%	Phimosis	1	33.3%	5.8%	0.9%
Total	17	100%	14.9%					

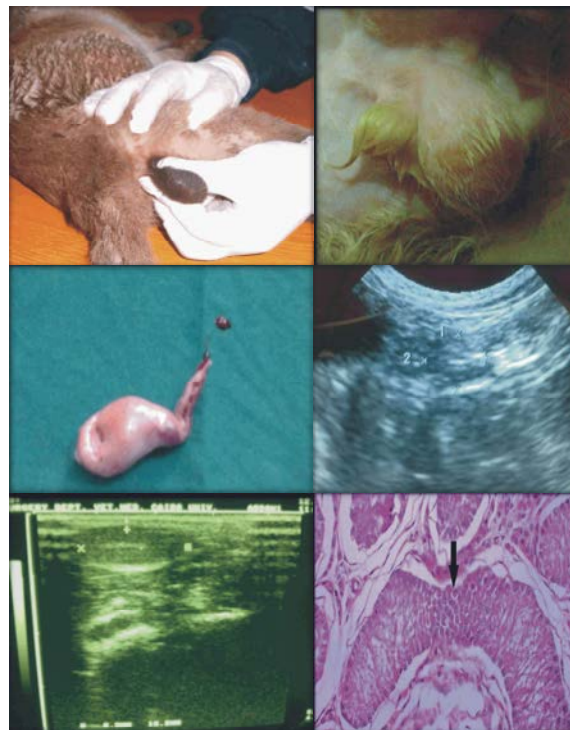


Fig. 1: (A, B&C) Cryptorchidism in tom cats. (D) B-mode sagittal scans at the level of the prepubic region in 6 months male Persian cat suffered from unilateral cryptorchidism. The testicle was located under the neck of the urinary bladder. There is hypoechoic testicle with hyperechoic rete testis at the mid of the testicle (1.8×0.6cm). (E) B-mode sagittal scan at the level of right region 8 months old male Persian cat suffered from unilateral ectopic testis. There is homogenous hypoechoic testis with hyperechoic rete testis and testicular capsule. The size of the affected testis was 1.8×0.9cm. (F) Seminiferous tubules had proliferation in Sertoli cells (Sertoli cell tumor) (arrow) (H&E×200)

Table 3: Surgical genital affections of queen cats

Affected organs	Number of affected animals	% to the total affected female cats (96)	% to the total affected cats (113)	Surgical affections	Number	% to the regional affected no. cats	% to the affected females (96)	% to the total affected cats (113)
Uterine and ovarian affections	85	88.5%	75.2%	Pyometra	52	61.2%	54.2%	45.6%
				Uterine prolapse	1	1.3%	1.0%	0.8%
				Uterine torsion	2	2.3%	2.1%	1.7%
Mammary gland affections	11	11.5%	9.7%	Mammary neoplasm	11	100%	11.5%	9.6%
Total	96	100%	85.5%					

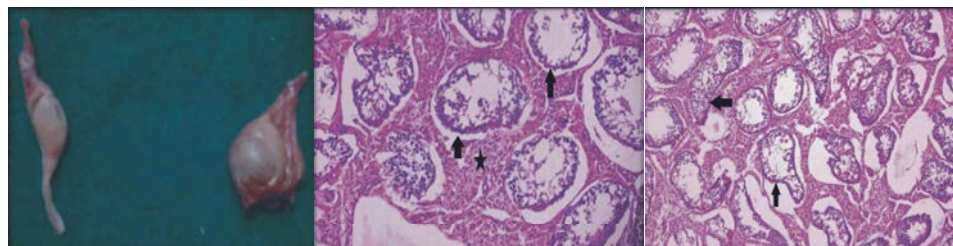


Fig. 2: (A) Testicular hypoplasia in cats. (B&C). Degenerative changes of most seminiferous tubules (Arrows) accompanied by edema. Marked proliferation of lying cells in the interstitial tissue (star) (H&E×400 & 200).



Fig. 3: (A) Penile necrosis in cats. (B) Phimosis in cats

Medicinal treatment of cats with open pyometra, included fluid therapy + amoxicillin plus clavulanic acid (20mg/kg b.wt, i.m)¹, second day PGF2-alpha (0.25mg/kg, s/c) + antibiotic + fluid therapy. Antibiotics were given from third - seven days. Atropine (10mg/kg, s/c)¹ was used to avoid side effect of prostaglandins. The results of medicinal treatment were not successful in 20 cats and in 13 were moderate responses.

Queen cats with closed pyometra and with open pyometra which were not responded to medical treatment were treated by OH. The results of surgical removal were successful in 33 female cats and seven female cats were died.

Histopathological results of five cats with open pyometra showed distended uterus with inflammatory exudates and inflammatory cells mainly neutrophils. This accompanied by ulcerated endometrial, hemorrhage and haemosidrine pigments. Uterine glands had hyper plastic proliferation of its epithelial lining with distended lumen by inflammatory cells mainly neutrophils. The endometrial stroma had infiltrated by mononuclear inflammatory cells mainly plasma cells and lymphocytes.

Most endometrial and myometrial blood vessels were dilated and filled with blood. The myometrium had degenerated muscle fibers with dispersing edema. Myometrium infiltrated by mononuclear inflammatory cells mainly plasma cells and lymphocytes.

Histopathological findings of closed pyometra (Three cats) showed hyperplastic and metaplastic proliferation of its stratified squamous epithelial lining. The cervical stroma were infiltrated by mononuclear inflammatory cells mainly plasma cells and macrophages. The muscular layer of the cervix had some degenerative changes accompanied by edema and inflammatory cell infiltration.

Other histopathological finding for closed pyometra (Four cats) showed that, in addition to endometrial lumen distended with inflammatory exudates and inflammatory cells mainly neutrophils, endometrial ulceration could be detected accompanied by hyper plastic and anaplastic proliferation of endometrial glands. Endometrial stroma were infiltrated by mononuclear inflammatory cells mainly plasma cells as well as atypical melanocytes could be detected in the endometrial stroma. Myometrium had sever degenerative changes with edema and mononuclear inflammatory cell infiltration mainly plasma cells (Fig. 4).

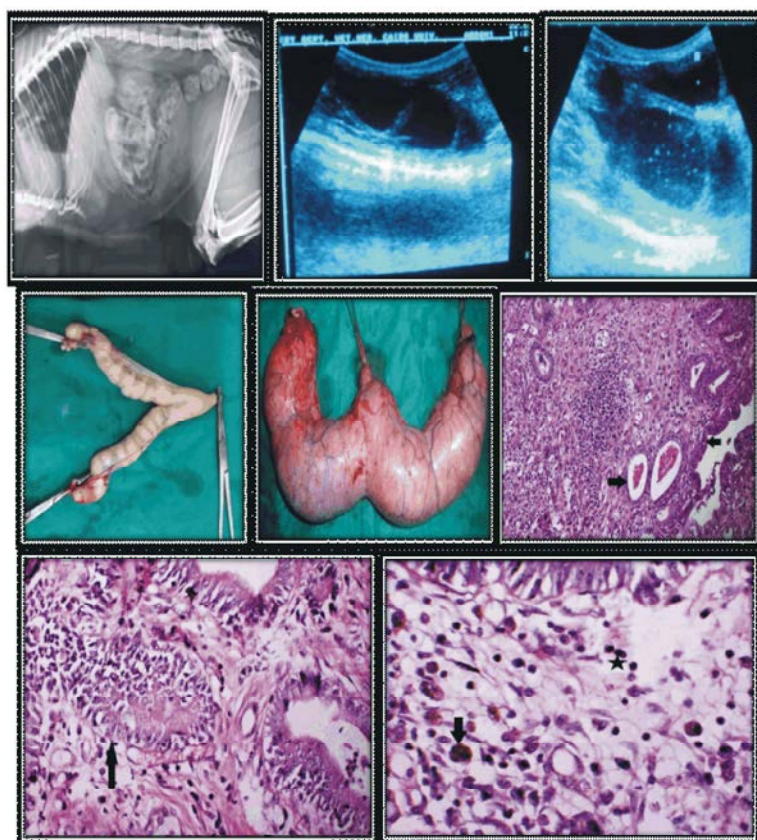


Fig. 4: (A) X-ray films of pyometra in queen cats. (B): B-mode ultrasound sagittal scans at the level of right flank region of 3- years old female Persian cat suffered from closed pyometra. A hyperechoic thickened wall with intraluminal trabiculi and anechoic content of the right uterine horn. (C): B-mode ultrasound sagittal scans at the level of left flank region of 5-years old female Persian cat suffered from closed pyometra. A hyperechoic wall and anechoic large amount contents with hyperechoic dotes (indicated flouting flanks and cellular elements). (D&E) Pyometra in cats.). (F) Endometrium showed hyper plastic proliferation of some endometrial glands others had esinophilic mucoid liquid (arrows) (H&E×200). (G) Endometrial gland had hyperplastic and anaplastic proliferation (arrow) (H&E×400). (H) Endometrial stromas were infiltrated by mononuclear inflammatory cells (star) mainly plasma cells as well as atypical melanocyte (arrows) (H&E×400)

Cat with uterine prolapse (Aged two years old) was represented by history of parturition from 48 hrs and given three doses of oxytocin. By examination, there was prolapse of both uterine horns. Motility of the uterus visualized. The uterine mass was slightly swollen, congested and protruded out about 6 cm from the base of the vulva.

The prolapsed uterus was cleaned with normal saline, lubricated with antiseptic cream and gently reduced into the vagina. No further complications till next parturition which was re prolapsed again, OH was made.

Uterine torsion was recorded in two Persian cats. Their age were ranged from 5-7 years old. One of them was whelped one dead kitten since 5 days. With anorexia, vomiting enlarged abdomen and no vaginal secretion.

Another female cat was delayed in parturition (ten days) with enlarged abdomen. The two female cats not received treatment during parturition and suffered from hypothermia (37°C).

OH /caesarian section were performed. The left and right uterine horns showed torsion in two cases respectively. There was putrefaction with blackish brown coloration and foul odor. The result of surgical treatment was successful in the first one and the other one died after two days from septicemia

Histopathological findings showed erosions and ulcerations of endometrium as well as sever atrophy of most endometrial glands. The endometrial stroma was highly infiltrated with mononuclear inflammatory cells mainly plasma cells and lymphocytes. Most endometrial

and myometrial blood vessels were highly dilated, filled with blood and inflammatory cells mainly neutrophils. Myometrium had different stages of degeneration accompanied by edema between muscle fibers. A denomyosis could be detected endometrial tissue comes to be within the myometrium.

Cat mammary neoplasms were diagnosed in 11 female cats. Their ages were ranged between 7- 15 years old and their weights ranged from 1.7 - 3 kg. Seven were Persian cats, two Siamese and two mixed breed cats. Mammary masses were of different size (2 - 5 cm). Multiple masses (Five cases movable and other five cases fixed to underline). Three of them were pedunculated, two cystic and five hard. All of them have no line of demarcations except three cats and three cases showed ulcerated masses.

Ten queen cats showed enlargement of inguinal lymph nodes. Six cases were suffered from bad general health condition. Two cases of them suffered from mechanical lameness and one case showed limb edema. X- Ray findings for feline mammary neoplasm showed extra abdominal radioopaque patches at the level of the inguinal mammary gland. Ultrasound findings showed as mixed echopattern of the mammary parenchyma with circumscribed anechoic cystic structure within the mammary tissues. Six cats were treated by mastectomy with favorable results.

Histopathological findings revealed complex carcinoma which consisted of proliferated epithelial cells with loss of glandular architecture and presenting pleomorphism and mitotic figures other patches showed population of cells had oval to fuse form vesicular nuclei with extensive amount of eosinophilic cytoplasm and distinct cells margins, extended between these cells different size blood vessels. Other patches of highly necrotic tissue could be seen accompanied by calcification.

DISCUSSION

In the present study, the total admitted number of cats was higher in the private clinics rather than the Surgery Department Clinic of Faculty of Veterinary Medicine due to cases come to the private clinics were not special surgical cases (Routine examination, medical, gynecological and surgical cases) while in surgery department all cases were suffering from specific surgical affections. In the same time, The percentage of the genital system affected cases were higher in private clinics (9 - 14.8 %) than Surgery Department (2.8%). Moreover, these results were more representative in the

private clinics, whereas all affections are admitted rather than the surgery department which is more specialized clinic for surgical interventions only.

In the present study, the percentage of surgical genital system affection in cats was 8.5% out of 1345 cats, suffered from different affections. Moreover, the total number of examined queen cat (725) was higher than tom cats (620) which may be due to owners' preference, mainly not to rear tom cats due to its bad habits of spring urine.

In this study, total surgical genital system affections were higher in queen cats (13.2%) than in tom cats (2.7%). To the best of our knowledge, no available literature were traced regarding the percentage of total surgical genital system affections in cats and mostly researcher are interested in single affections .

The current research revealed that testicular affections (82.4%) have the highest incidence among surgical affections of male genital system in cats followed by penile affections (17.6%). Moreover, cryptorchidism was recorded in 70.6% from the total affected tom cats. These results disagree with Milis *et al.* [11], Scott *et al.* [12] and Ronald [13] who reported that cryptorchidism is a rare condition in cats, with incidence ranging from 0.4 - 2 %. The high incidence of cryptorchidism may be due to inexpert selection of cat breeders of pure blood line as Johnston *et al.* [14], Memon and Tibary [41] and Reif and Brodey [42] said that it was congenital or inherited disease.

Uterine affections in this study (88, 5%) showed the highest incidence among surgical affections of queen genital system followed by mammary gland affections (11.5%). Moreover, uterine affection, in the present work revealed the highest incidence as represented in pyometra (54.2 %). These results disagree with Scott *et al.* [12] and Stanley and Pacchiana [20] who published that pyometra in cats is not common (0.4%). Mostly these affections are related to unsafe use of contraceptive among owners.

From the obtained data, the most common surgical affection of the mammary gland was mammary neoplasm representing 11.5% out of total affected queen cats. These results agree with Misdorp and van der Heul [31], Sanchez *et al.* [32], Amorim *et al.* [33], Mcaloose *et al.* [34], Pliego *et al.* [35] and Fusaro *et al.* [36] who stated that the mammary tumors in cats represented 12% of them and disagree with Murphy [43] who reported that the risk of developing mammary gland tumors was 0.05%.

Diagnosis of mammary gland tumors depended mainly on physical and Ultrasonographic examinations. The results which agree with Sontasa *et al.* [44] who concluded that mammary tumor was usually suspected on detection of a mass during physical examination.

It was concluded that surgical affections of genital system represent a considerable incidence among total surgical affection in both tom and queen cats. Cryptorchidism and pyometra are the most detected genital affections in tom and queen cats, respectively

REFERENCES

1. Senna, N.A., 2001. Observations on some aspects of dogs and cats ownership: A new role for veterinarians. *Egypt Vet. Med. Ass.*, 61: 199-216.
2. Bleibreg, Edward, Soulful and Creatures, 2013. *Animal Mummies in Ancient Egypt*, Brooklyn Museum.
3. Boothe, H.W., 2003. Penis, prepuce and scrotum, in Slatter D (ed): *Textbook of Small Animal Surgery*, ed 3. Philadelphia, WB Saunders, 2003, pp: 1532-1541.
4. Valerla, Grieco, Elenariccardi, Ancalungu, Chiaragiudice and M. Finazzi, 2007. Frequency of Canine Testicular Tumors.
5. Smith, J., 2008. Canine prostatic disease, a review of anatomy, pathology, diagnosis and treatment; *Theriogenology*, 70: 375-383.
6. Wykes, P.M. and P.N. Olson, 2003. Vagina, vestibule and vulva. In: Slatter DH (ed.). *Text book of Small Animal Surgery*. 3rd ed. pp: 1502-1510, Saunders, Philadelphia.
7. Zatloukal, J.J., F. Lorenz ova, A. Tich, H. Neaas, P. Kecova and Kohout, 2005. Breed and Age as Risk Factors for Canine Mammary Tumours. *Acta Vet.*, 74: 103-109.
8. Schlafer, D.H. and A.T. Gifford, 2008. Cystic endometrial hyperplasia, pseudo-placentational endometrial hyperplasia and other cystic conditions of the canine and feline uterus. *Theriogenology* 2008, pp: 349-358.
9. Vince, S.B, A. Zevrnja, I. Beck, D. Folonozic, M. Geres, J. Samardzija, J. Grizel and Dobranic, 2011. Unilateral segmental aplasia of the uterine horn in a gravid bitch- a case report. *vet.archiv*81, pp: 691-698.
10. Fossum, T.W., 2013. Surgery of the genital and reproductive systems in small animal surgery, in Fossum TW (eds.) 4thed, Elsevier Mosby, Philadelphia, pp: 825.
11. Milis, D.L., J.G. Hauptman and C.A. Johnson, 1992. Cryptorchidism and monorchidism in cats: 25 cases (1980 - 1989). *J. Am. Vet. Med. Assoc*, 200: 1128-1130.
12. Scott, K.C., J.K. Levy and P.C. Crawford, 2002. Characteristics of free-roaming cats evaluated in a trap-neuter-return program". *J. Am. Vet. Med. Assoc*. 221(8): 1136-8. doi: 10.2460/javma.2002.221.1136. PMID 12387382.
13. Ronald, M. Bright., 2011. *Cryptorchidism in Dogs and Cats* by Saunders, an imprint of Elsevier Inc. All Rights Reserved.
14. Johnston, S.D., M.V. Root-Kustritz and P.N.S. Olson, 2001. *Canine and Feline Theriogenology*, WB Saunders Ed. Philadelphia 2001, pp: 592.
15. Knighton, E.L., 2004. Congenital adrenal hyperplasia secondary to 11 β -hydroxylase deficiency in a domestic cat. *J Am Vet Med Assoc* 225:238, 2004. PubMed.
16. Johnson, C.A., 2014. *Mechanisms of Disease in Small Animal Surgery*, 3rd Ed., Bojrab M.J. and Monnet E. (Eds.). Publisher: Teton New Media, Jackson, WY, USA (www.tetonnm.com/). Internet Publisher: International Veterinary Information Service, Ithaca NY (www.ivis.org).
17. Lysimachos, G. Papazoglou and George M. Kazakos, 2002. Surgical Conditions of the Canine Penis and Prepuce. *Compendium*, 46(24), No. 3 March 2002. Vol 2.
18. Fossum, T.W., 2012. *Small Animal Surgery*, 4th ed. Philadelphia, Mosby, pp: 666-674.
19. Autumn, P., D.V.M. Davidson and M.S. Dacvim, 2013. Balanoposthitis. Merck Sharp and Dohme Corp., a subsidiary of Merck and Co., Inc., Whitehouse Station, N.J., U.S.A.
20. Stanley, S.W. and P.D. Pacchiana, 2008. Uterine torsion and metabolic abnormalities in a cat with pyometra. *Can. Vet. J.*, 49: 398-400.
21. Benesch, F. and J.G. Wright, 2001. *Veterinary Obstetrics*. Greenworld Publishers: Lucknow, pp: 388-392.
22. Slatter, D., 2002. *Textbook of Small Animal Surgery*, Vol II. 3rd ed. W.B. Saunders Co: Philadelphia, 2002; 1494-1495. *Small Anim Pract*, 21: 533-44.
23. Ozyurtlu, N. and D. Kaya, 2005. Unilateral Uterine Prolapse in a Cat. *Turk J. Vet. Anim. Sci.*, 29: 941-943.
24. Fossum, T.W., C.S. Hedlund and A.L. Johnson, 2007. *Small Animal Surgery*, 3rd ed. Mosby Publication: Missouri, pp: 744-747.
25. Dipanjan Chakraborty, Amit Kumar Nath and Debaki Ghosh, 2012. Surgical Treatment of Bilateral Gravid Uterine Prolapse in a Female Dog - A Case Report Chakraborty., *IJAVMS*, 6: 148-149.
26. Crane, B. and M.A. Kutzler, 2015. *Mechanisms of Disease in Small Animal Surgery*, 3rd Ed., Bojrab M.J. and Monnet E. (Eds.). Publisher: Teton NewMedia, Jackson, WY, USA (www.tetonnm.com/). Internet Publisher: International Veterinary Information Service, Ithaca NY (www.ivis.org), Last updated: 19-Jan-2015; A5676.0115.

27. Jackson, P.G.G., 2004b. Dystokia in the dog and cat In: Jackson P.G.G.: Handbook of Veterinary Obstetrics, 2nd ed. W.B. Saunders Company, Philadelphia, pp: 141-166.
28. Raut, B.M., D.S. Raghuwanshi, S.V. Upadhye, B.M. Gahlod, A.P. Gawande, P.R. Sirsat and P.R. Wankhade, 2008. Uterine Torsion in a Bitch Veterinary World, 1: 212.
29. Barrand, K.R., 2009. Unilateral uterine torsion associated with haematometra and cystic endometrial hyperplasia in a bitch. Vet. Rec., 164: 19-20.
30. Kumru, I.H., K. Seyrek-Intas, Y. Walter, D. Seyrek-Intas and A. Wehrend, 2009. Incidence of uterine torsion as a case of dystocia in bitches. Reprod. Domest. Anim. (Suppl. 1), 44: 21-22.
31. Misdorp, W. and R.O. Van Der Heul, 2002. Carcinosarcomas of the dogs. Vet. Pathol., 17: 53-57.
32. Sanchez, J., A.J. Buendia and Vilafranca, 2005. Canines carcinosarcomas in the head. Vet. Pathol., 42: 828-838.
33. Amorim, F.V., H.J.M. Souza and A.M.R. Ferreira, 2006. Clinical, cytological and histopathological evaluation of mammary masses in cats from Rio de Janeiro, Brazil. J. Feline Med. Surg., 8: 379-388.
34. Mcaloose, D., L. Munson and D.K. Naydan, 2007. Histologic features of mammary carcinomas in zoo felids treated with melengestrol acetate (MGA) contraceptives. Vet. Pathol., 44: 320-326.
35. Pliego, C.M., M.L.G. Ferreira and A.M.R. Ferreira, 2008. Diagnostic quality of mammary nodes biopsy with Super-core II® needle of bitches. Cienc. Rural., 38: 2203-2209.
36. Fusaro, L., S. Panarese and B. Brunetti, 2009. Quantitative analysis of telomerase in feline mammary tissues. J. Vet. Diagn. Invest., 21: 369-373.
37. Keer, M.G., 2002. Veterinary Laboratory Medicine, Clinical Biochemistry and Haematology. Blackwell Science, pp: 3-34.
38. Kaneko, J.J., J.W. Harvey and M.L. Bruss, 2008. Clinical Biochemistry of Domestic Animals. 6th ed. San Diego, CA: Academic Press, 493: 889-895.
39. Tsumoro, H., E. Hiyama, T. Kodama, T. Sueda and T. Yokoyama, 2003. Relevance of antimicrobial agent-induced endotoxin release from in vitro cultured Escherichia coli and in vivo experimental infection with gram negative bacilli. Int. J. Antimicrobial Agent, 21: 463-470.
40. Coles, E.H., 1986. Veterinary clinical pathology, 4th ed W.B. Saunders Company, Philadelphia, London.
41. Memon, M. and A. Tibary, 2001. Canine and Feline Cryptorchidism In: Recent Advances in Small Animal Reproduction, P. W. Concannon, G. England and J. Verstegen (Eds.) Publisher: International Veterinary Information Service (www.ivis.org), Ithaca, New York, USA.
42. Reif, J.S. and R.S. Brodey, 2005. The relationship between cryptorchidism and canine testicular neoplasia., JAVMA 1969; 155.
43. Murphy, S., 2008. Mammary tumours in dogs and cats. In practice, 2008/6, pp: 334-339.
44. Sontasa, B.H., H. Ozyogurtcub, A. Gurelb and H. Ekicia, 2009. Evaluation of clinical and pathological characteristics of 155 canines with mammary tumours: a retrospective study Arch. Med. Vet., 41: 53-59.