Macroscopic and microscopic evaluation of a cryptorchid testis in cat: a case report

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Session: 2017-2018

A clinical report submitted in partial satisfaction of the requirement for the Degree of **Doctor of Veterinary Medicine (DVM)**

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October, 2023

Macroscopic and microscopic evaluation of a cryptorchid testis in cat: a case report

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October, 2023

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Abstract

Cryptorchidism is considered as a heritable reproductive disease in cats and the failure of testis descending occurs mostly at birth or shortly after birth. Persians were considered as most susceptible breed for cryptorchidism according to various reports. No significant symptoms were determined as the mean of detecting the cryptorchidism, thus different diagnostic techniques like physical examinations, palpation, ultrasonography or X-ray imaging used normally. However, laparotomy is the mostly recommended treatment protocol for the condition. In our current study, we also adapted the technique. This is a histopathologic and endocrinologic study of a persian tomcat that was affected with left abdominal cryptorchidism. In this study, we have found different macroscopic and microscopic changes in cryptorchid testis and also proved the hormonal activity of cryptorchid animal. There were so many significant changes recorded in this study such as changes in external appearance of affected testis, histological degenerations, disorganization of testicular cells etc. and in hormonal assay there was found a small amount of testosterone in blood.

Keywords: Cryptorchidism, Endocrinology, Histopathology, Laparotomy.

Chapter-I

Introduction

Cryptorchidism can be defined as the failure of descending of single or both testes from abdomen in the scrotum within the due time for specific species after birth. It is one of the most common congenital reproductive anomalies of animals (Khan *et al.*, 2018). Normally, the condition is detected at birth or within a very short time after birth. The undescended testicle may be retained in the inguinal canal, in the abdominal cavity or alongside of penis and prepuce at the base of scrotum and sometimes it may be located in subcutaneous tissues in the groin region, in between inguinal canal and the scrotum (Romagnoli,1991). According to Richardson and Mullen, the cryptorchid testis located in inguinal, intra-abdominal and pre-scrotal region was 49%, 33% and 14% respectively.

Various reports exhibit that the occurrence of cryptorchidism approximately 1-10% and 2% in dog and cat respectively. Smaller breeds of dogs are 2.7 times more prone to be affected then the larger ones, like Chihuahuas, Poodles, Yorkshire terriers, Pomeranians (Mattos *et al.*,2000). In case of cats, it occurs more often in purebred or pedigreed cat which is 1.3-6.2% and Persians are more seen to be affected among all breeds (Little,2011). Some other reports demonstrated that the prevalence of cryptorchidism are 100%, 90%, 81-93%, 66-89%, 78%, 45-70%, 62% and 59% in rabbits, bulls, stallions, men, tomcats, dogs, sheep and pigs respectively (Yates *et al.*,2003). Although real cause of the condition is still unknown, but it is considered to be inherited in tomcats.

Cryptorchidism can be classified into unilateral and bilateral, among which first one is considered more common (78-90%), where right and left both are equally affected[2]; but some reports show that right testis is most likely to be affected (Little,2011).

In cryptorchid testis testosterone production is reported, but spermatogenesis not occurred due to the thermal suppression. That's why, animals with bilateral cryptorchidism is normally infertile, although they may show the reproductive

behaviour due to the presence of reproductive hormone. Whereas unilateral cryptorchidism may shows the fertility in animals as one testis remain active (Mattos *et al.*,2011). Furthermore, some other reports showed that the cryptorchid testis more prone to develop neoplastic tissue about 13.6 times than the normal testicle (Gubbels *et al.*,2009).

Diagnosis of internal cryptorchidism is somewhat difficult only by palpating due to the smaller size of retained testicle, hence ultrasonographic examination or X-ray is generally considered effective in this case (Felumlee *et al.*,2012). Cryptorchidectomy is the treatment of that can be choose for the cryptorchidism in cats, as there is a risk of testicular torsion and development of testicular neoplasia sustained and also the cryptorchid testis produce testosterone (Brückner 2015). But according to literature, the recommended management of intra-abdominal cryptorchidism is a laparotomy in caudal midline approach (Richardson & Mullen,1993). However, in some reports laparoscopy and laparoscopy-assisted cryptorchidectomy was recorded (Gomez *et al.*,2023).

Objectives

1. To know the macroscopic and microscopic features of cryptorchid testis in tomcat.
2. To compare the gross and microscopic structures of normal and cryptorchid testes
3. To prove the hormonal activity in cryptorchid animals.

Chapter-II

Materials and Methods

Animal

The study is conducted in Department of Anatomy and Histology of Chattogram Veterinary and Animal Sciences University in Bangladesh from February to October 2023. The tomcat was detected as cryptorchid by attending doctor by doing clinical examination, palpation and X-ray imaging of lower abdominal region. Our study cat was of Persian breed and it was affected by left abdominal cryptorchidism.

Surgical procedure

The study cat was affected by unilateral abdominal cryptorchidism. The animal was prepared for the Laparotomy accordingly and fastened for 8 hours before surgery. It was anasthesized by using a mixture of Xylazine and Ketamine intra-muscularly at 1 mg/kg and 10 mg/kg repectively. Then the surgical site was aseptically prepared by clipping, shaving and cleaning. After that disinfection was done using savlon, 70% alcohol and 10% povidon iodine respectively and then a midline incision was made through the skin and muscles of abdomen, between navel and the pubic bone. Then after finding the vas deferens was severed and ligated using an absorbable suture (Catgut, USP 2.0). Finally the testis was removed from the spermatic chord and then the abdominal muscle was sutured with Catgut USP 2.0 and the skin was sutured with a non-absorbable suture (Nylon USP 2.0). Later the post-operative care was conducted for 7 days with antibiotic (Ceftriaxone at 30mg/kg), antihistaminic drug (Chlorpheniramine maleate at 0.5mg/kg) and anti-inflammatory drug (Meloxicam at 0.1mg/kg) and the suture was removed after 15 days.

Tissue processing & histopathology

The sample from normal and cryptorchid testis was collected and preserved for histopathology by using 10% neutral buffered formalin and then processed according to literatures. The steps for tissue processing are as follows-

Fixation with 10% Formalin- Dehydration using Alcohol- Clearing with Xylene- Infilttration & Embedding with Paraffin.

After the processing the tissues were sectioned in microtome machine at 5µm thickness and then these were placed on glass slide and stained with Hematoxylin and Eosin stain (Suvarna *et al.*,2018).

Chapter-III

Results

3.1 Clinical findings

Normally cryptorchidism cannot be diagnosed externally. In case of our study animal, at first it was neutered by attending veterinarian, but then only one testicle was removed. After a while, the cat was showing reproductive behaviour that proved that the remained abdominal testicle was secreting reproductive hormones. To confirm the cryptorchidism, abdominal palpation and X-ray was performed. Then the cryptorchid testis was removed by the doctor by doing laparotomy.

3.2 External morphology

Our current study exhibits a huge deviation of external appearance in cryptorchid testis than the normal one. The cryptorchid testis was somewhat smaller than the normal testis and it was atrophied. Also the testis was congested. In the table 1, there is shown some measurements of both normal and cryptorchid testis done for the convenience of the study.

Fig 1: External morphology of normal (black arrow) and cryptorchid (red arrow) testes

Table 1: Measurements of normal and cryptorchid testis

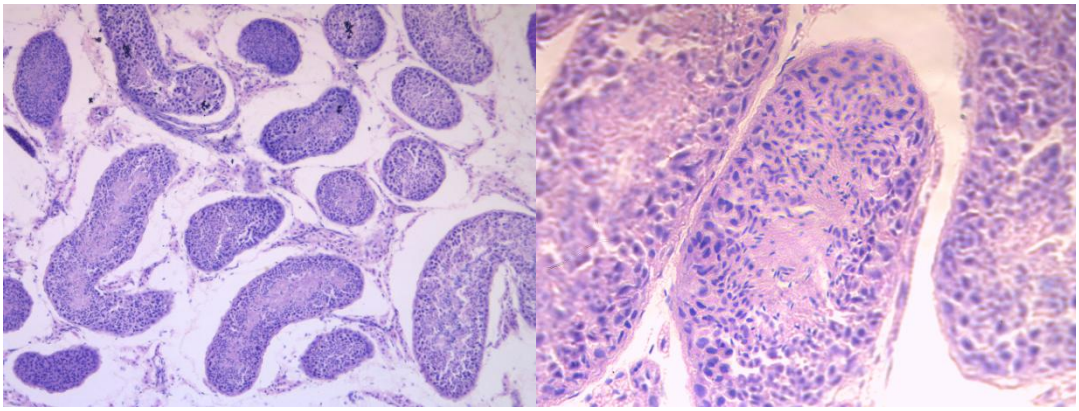
	Measurment (with epididymis)	**Epididymis**	
Normal testis (Right)	Length- 19.18 mm	Head	Length – 6.96 mm
			Width- 5.42 mm
	Width- 14.3 mm	Body	Length- 13.48 mm
			Width- 1.67 mm
	Diameter- 5 cm	Tail	Length- 5.69 mm
			Width- 5.16 mm
Cryptorchid testis (Left)	Length- 17.88 mm	Head	Length- 6.48 mm
			Width- 2.88 mm
	Width- 8.44 mm	Body	Length-10.06 mm
			Width- 1.45 mm
	Diameter- 3.2 cm	Tail	Length- 5.85 mm
			Width-3.07 mm

3.3 Histological observations

The previously prepared histological slides of normal and cryptorchid testes were observed under 10X and 40X objectives to evaluate the changes of different cells. In normal testis, the stages of spermatogenesis are demonstrated in seminiferous tubules that show all the cells including spermatogonia, primary spermatocyte, secondary spermatocyte, spermatids and spermatozoa.

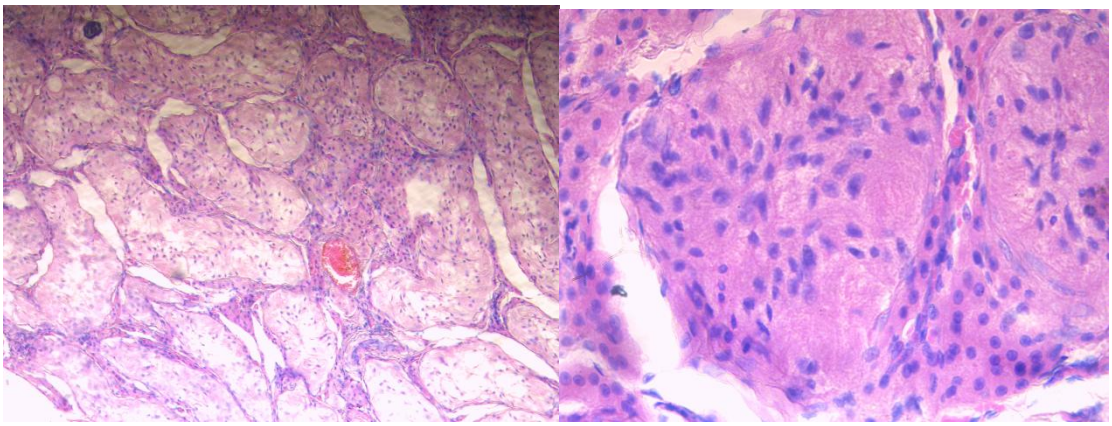
On the other hand, the cryptorchid testis shows atrophied structures with smaller seminiferous tubules that contain few spermatogonia. However, the basement membrane seemed to be thickened than normal and the diameter of the tubules appeared somewhat reduced than the normal ones. Also unlike normal testis the architecture of seminiferous tubules are not intact and the germ cells of are appeared more or less disorganized compared to their normal position. Again in normal testis there is enough cytoplasm with enough inter-tubular spaces, but in cryptorchid testis there seemed to less inter-tubular spaces with less cytoplasmic materials.

Finally, it can be concluded that the microscopic features of cryptorchid testis is degenerative and disorganized when compared to the normal testis.



a **b**

Fig 2: Microscopic features of normal testis in (a) low magnification (10X) and (b) high magnification (40X)



a **b**

Fig 3: Microscopic features of cryptorchid testis of tomcat in (a) low magnification (10X) and (b) high magnification (40X)

3.4 Endocrinologic Assay

Blood sample was collected from the study animal and it was examined for checking the blood testosterone level in a sophisticated and renowned diagnostic lab. The level of testosterone was in the blood of the tomcat was 0.33 ng/ml. According to some previous report, average blood testosterone level in tomcats is 3.42±0.49 ng/ml, which indicates low testosterone production in cryptorchid cats (Mosallanejad *et al.*,2019).

Chapter-IV

Discussion

Cryptorchidism is considered as a common genital disorder of male animals in which normal process of descending testis into scrotum is disturbed, it can be either in one testis or both. Many report demonstrated that among all cat breeds Persians are mostly to be affected by the cryptorchidism that is also the same as our study case. Again according to different studies conducted before the incidence of unilateral cryptorchidism is more and right testicle is more likely to be affected than the left one that is about 84.2% (Yates,2011). Contrarily, some other researchers reported that there is no difference in the prevalence of right and left cryptorchidism (Felumlee *et al.*,2012).

In different studies, there showed the anatomical structures of cryptorchid testis is greatly affected by the deformity as well as the histological structures of cryptorchid testis that revealed disorganization of germ cells and sloughing off of the cells into the lumen, reduced spermatogenesis, less or no Sertoli cells, Leydig cell hyperplasia and interstitial hemorrhages. These changes may have resulted in the reduced tubular diameter and reduced number of spermatogonia that subsequently results in infertility in the animals (Ali *et al.*,2022). In our current study, we have also found that there are many changes in appearances of cryptorchid testis than the unaffected one like size, shape, length, width and diameter and also there found some significant histological changes like germ cells disorganization, thickened basement membrane, reduced cytoplasm and tubular diameter and the findings are very much similar to the previous studies.

In some other studies there also some other findings were recorded like collagen deposition in interstitial space, hyaline thickening of basement membrane and atrophied germinal epithelia (Babaei *et al.*,2010).

The study also includes the hormonal assay of blood testosterone level in the cryptorchid tomcat where 0.33 ng/ml blood testosterone was found. Some previous

studies support the result as these reported lower testeosterone production by the cryptorchid testis.

It can be concluded that though the cryptorchid testis can produce testosterone hormone even in low amount and show the reproductive beghaviour, but it has no ability to conduct normal procedure of spermatogenesis and that's why cryptorchid animals must show infertility.

Chapter-V

Limitations

There were many difficulties had to face during the study. Some majors of them are as follows-

- Insufficient previous research papers on the feline cryptorchidism
- Insufficient histopathological and endocrinologic data on cryptorchid testis

Chapter-VI

Conclusion

The present study describes the degenerative changes occurs in abdominal cryptorchid testis when compared to the normal testis. There found some external changes in the retained testis and histological degeneration. The changes include smaller and atrophied testicle, thickened basement membrane, reduced germ cells, interstitial haemorrhage, leydig cell hyperplasia etc. Also in endocrinological examination there is found a small amount of testosterone in blood sample that proves the hormonal activity of cryptorchid testis. Since there are very few reports are available on feline cryptorchidism, the report may contribute as the basis for the future research on the histopathology and endocrinology of feline cryptorchidism.

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Acknowledgments

All praises are due to the Almighty, the Supreme authority of this universe, who enabled the author to pursue the study work and the successful completion of the report.

With great pleasure, the author also would like to express her deepest sense of gratitude, sincere appreciation, profound regards and immense indebtedness to her honorable teacher and clinical report supervisor Dr. Subrata Kumar Shil, Department of Anatomy and Histology, Faculty of Veterinary Medicine, CVASU for his scholastic guidance, sympathetic supervision, valuable suggestions and comments throughout the entire period of the study work and in preparation of this report.

In the completion of this work, the author would like to express her sincere gratitude and heartfelt respect to the honorable Vice Chancellor Prof. Dr. Lutful Ahsan, Prof. Dr. Mohammad Lutfur Rahman, honorable Dean Faculty of Veterinary Medicine, Chattogram Veterinary and Animal Sciences University (CVASU) and also to Director of external affairs Prof. Dr. A. K. M. Saifuddin, Department of Physiology, Biochemistry and Pharmacology, CVASU.

The author also sincerely appreciates the assistance of all the teaching and non-teaching members of her working department.

Last but not the least, the author wishes to express ever gratefulness and immensely indebt endless to her respected parents for their heartiest blessings, affectionate feelings, encouragement and all sorts of sacrifices for the author's higher education and successful completion of this study work. Also she expresses her gratitude to her friends, seniors and well-wishers for their continuous support.

The Author

October, 2023

Biography

I am Kazi Asma Akther daughter of Kazi Md. Selim Ullah and Rasheda Khanom. I have completed my Secondary School Certificate examination from Bakalia Govt. High School under Chattogram board in 2014 (G.P.A-5.00) and Higher Secondary School Certificate examination from Hazera-Taju Degree College under Chattogram board in 2016 (G.P.A-5.00). Then I have admitted in Chattogram Veterinary and Animal Sciences University to receive DVM degree under the Faculty of Veterinary Medicine which is a combined degree of veterinary medicine, husbandry practice and basic sciences with a one year comprehensive internship and now I am an intern veterinarian. I have a keen interest in veterinary medical research and I want to serve the nation through my knowledge and creativity so that we can conquer the current challenges in this field.