

Gross and Histoarchitecture studies on the Epididymis of Indian Mongrel Dogs

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ABSTRACT

Study on the gross and micro anatomical details of the epididymis of dogs from pre- and post-pubertal age groups were recorded. The epididymis was attached to the dorso-lateral surface of the testis. The epididymis was attached to the cranio-dorsal margin of the testis. Values on the various gross morphometric parameters showed a significant difference as age advanced in both the species. Epididymis was covered by tunica albuginea composed of a tunica fibrosa and tunica vasculosa. The epithelium of epididymis was made of pseudostratified ciliated columnar type. Basement membrane of tubule, blood vessel and stereocilia showed intense activity of mucopolysaccharides. Spermatozoa were situated in longitudinal disposition with their major axis parallel to the apical surface of the epithelium and perpendicular to the larger diameter of the epididymal duct. Spermatozoa formed compact packages within the lumen of epididymis.

Key Words: Epididymis, Histology, Dog

INTRODUCTION

A steady increase in the pet and stray animal population has paved way for an increase in infertility cases in both canine species, thus emerging as a major threat to public health. This created the need to study and understand canine breeding and infertility. The testis is an endocrine as well as an exocrine gland. The maturation of reproductive system depends on the capacity of the production quantity of androgens from the interstitial cells and the production of optimal number of viable sperms from the testis (Hafes and Hafes, 2000). At various ages the male passes through certain androgenic phases, Leydig cells of the testis secrete the testosterone which influences the development of testis and accessory reproductive structures. The characterization of puberty with associated changes in the reproductive organs is the available tool for selection of a male for breeding (Verma and Sahni, 1997). The impact of age on male fertility has been extensively studied in men; however, such information is limited in dogs. In humans, testicular volume, the number of germ cells and Sertoli cells, serum testosterone levels, daily sperm production, sperm viability, and sperm fertilizing capacity are known to decrease

in older men (Gunes *et al.*, 2016). A thorough knowledge of histological changes is also very essential to gain a comprehensive knowledge on the reproductive physiology and to form a base line for interpretation of various pathological conditions of the testis and duct system. Keeping this in view, the present study was designed to create basic documentary evidence about the histological details about the testis of dogs and cats during pre-pubertal and post pubertal stages.

MATERIALS AND METHODS

The samples were collected from apparently healthy animals admitted for elective castration. Age of dogs were determined based on the owner's history. According to age, the animals were classified into two groups as pre-pubertal and post-pubertal animals. The animals were subjected to castration as per the standard protocol under strict aseptic conditions. The tissue samples were washed with normal saline and fixed in 10 per cent neutral buffered formalin and Bouin's fixatives. The tissue samples were processed as per the standard procedures (Spencer and Bancroft, 2013). Sections of 5 – 6 µm thickness were used for routine Haematoxylin and Eosin procedure and special staining techniques namely, Haematoxylin and Eosin (H&E) method (Bancroft, 2013), Masson's Trichrome method (Luna, 1968), van

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Gieson's method for collagen fibres (Luna, 1968) and Gomori's silver method for reticular fibers (Luna, 1968). Micrometrical observations were recorded by calculating the average of four fields from each prepared slide. These observations were recorded for various parameters like, number of Sertoli cells /mm², thickness of testicular capsule (¼m), diameter of the seminiferous tubules (¼m) and height of the seminiferous tubules (¼m).

RESULTS AND DISCUSSION

Gross morphology

In dogs, the epididymis was firmly attached to the caudo-lateral border of testis. Similar observations were made by Dyce *et al.* (2017) in dogs and cats, Bhagyalakshmi *et al.* (2020) in dogs, Paul *et al.* (2020) in Asiatic Lion, Ziehmer *et al.* (2013) and Konig and Liebich (2014) in pigs. The epididymal duct was divided into caput, corpus and cauda regions. Caput and cauda attached to the cranial and caudal poles of testis as reported by Evans *et al.* (2019). The epididymis appeared as a straight elongated tubular structure in dogs. The caput and cauda epididymis were firmly attached to the testicular capsule and was reddish white in colour. This is in agreement with the findings of Dyce *et al.* (2017) in domestic animals.

Histology of epididymis

In the present study, no histological differences were observed between the epididymis of right and left side.

Capsule and stroma

The epididymal duct was covered by tunica albuginea and was further differentiated into tunica fibrosa and tunica vasculosa (Fig.01). In the present study the tunica albuginea of epididymis consisted mainly of collagen (Fig.02) and reticular fibers (Fig.03) with few elastic fibers (Fig.04) surrounding the blood vessels. Similar findings were reported by Parul (2015) in sheep who stated that mesenchymal connective tissue formed the future tunica albuginea on 65th day of gestation. He further reported that the thickness of capsule further increased with abundant reticular and collagen fibers while the tunica vasculosa contained large blood vessels by 137th day of gestation within the capsule.

Parenchyma

The parenchyma of epididymis consisted of tubules with distinct boundaries of connective tissues. A thin layer of smooth muscle cells surrounded the epithelium of entire epididymal tubules (Fig.05). Similar finding was reported by Cleland (1957) and Hoffer *et al.* (1973) in rat, Nabeyama and Leblon (1974) in monkey and Eurell and Brian (2006) in bull. Moustafa and Hafez (1971) reported that a thin layer of smooth muscle cells surrounded the epithelium of entire epididymal duct in bovine foetus and the thickness of these layers increased distally. Flickinger *et al.* (1978) stated that the epithelium of the hamster epididymis is composed of several cell types. The PC (Principal cells) were most numerous and accompanied by small BC (Basal cells) with few organelles and by halo cells. The proximal part of the epididymis contains AMRC (Apical mitochondria-rich cells). The epithelium of epididymis tubule consisted of several cell types - Principal cells (PC), Basal cells (BC), apical mitochondria-rich cells (AMRC) and halo cells. PC were tall columnar and extended the full thickness of the epithelium from basal lamina to the lumen (Fig.06). The apical surface of PC showed long stereocilia, which often branched near their base. The lumen of the epididymis contained spermatids and breakdown products in addition to spermatozoa. Flickinger *et al.* (1978) stated that the epithelium of the hamster epididymis is composed of several cell types. According to him, PC (Principal cells) were the most numerous and were accompanied by the small BC (Basal cells) with few organelles and by halo cells. The proximal part of the epididymis contained AMRC (Apical mitochondria-rich cells).

Epithelium

The lining epithelium of efferent ductules was simple cuboidal to low columnar with scattered basal cells and that of ductus epididymis and ductus deferens was pseudostratified ciliated columnar epithelium (Fig.07 & 8). Similar findings were reported by Wrobel (1972) and Eurell and Brian (2006) in bovine. Singh and Dhingra (1971) observed that the ductus epididymis in buffalo was lined by pseudostratified columnar epithelium

surrounded by small amount of loose connective tissue. Naidu (1991) observed that the epididymal tubules in ram lambs revealed pseudostratified columnar epithelium. Russe and Sinowatz (1991) reported that epididymal duct showed simple cuboidal to low columnar epithelium, which

differentiated later on into the characteristic tall columnar cells with stereocilia in bovine foetus. Gaykee *et al.* (2008) stated that the pseudostratified columnar epithelium of epididymal tubule in horse had tall columnar principal cells and short basal cells.

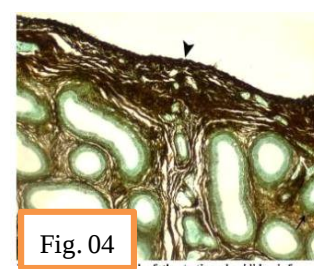
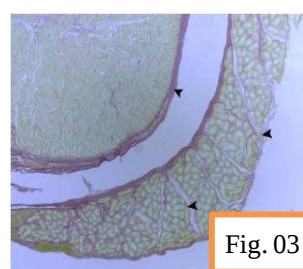
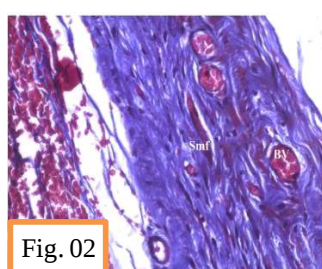


Fig.01 Photomicrograph of epididymis from pre-pubertal dog showing the tunica fibrosa (Tf) and Tunica vasculosa (Tv) of the capsule Masson's trichrome X 100 **Fig.02** Photomicrograph of epididymis from post-pubertal dog showing the capsule smooth muscle fibre (Smf) and blood vessel (BV) Masson's trichrome X 400 **Fig.03** Photomicrograph of testis and epididymis from pre-pubertal dog showing the distribution of collagen fibres in the capsule and septulae (arrow heads) Van Gieson's X 100 **Fig.04** Photomicrograph of testis and epididymis from pre-pubertal dog showing the distribution of reticular fibres in the capsule and septulae (arrow heads) Gomori's X 100

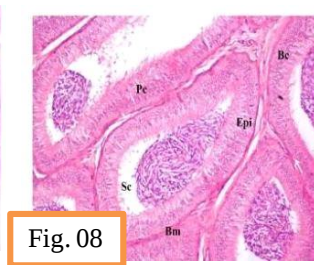
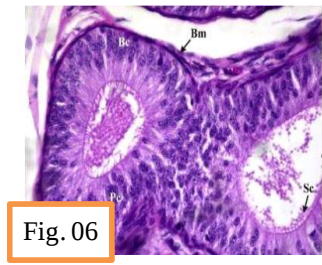
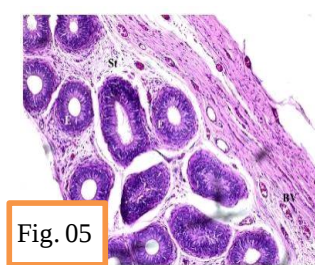


Fig.05 Photomicrograph of epididymis from pre-pubertal dog showing C-Capsule, BV-Blood vessel, E-Epithelium, St-Stromal tissue H&E X 100 **Fig.06** Photomicrograph of epididymis from pre-pubertal dog showing the distribution of the cellular details of the lining epithelium Bm-Basement membrane, Bc-Basal cells, Pc-Principal cells, Sc-Stereocilia H&E X 400 **Fig.07** Photomicrograph of epididymis from pre-pubertal dog showing the distribution of the cellular details of the lining epithelium Bm-Basement membrane, Bc-Basal cells, Pc-Principal cells, Sc-Stereocilia My-Myoid cell H&E X 400 **Fig.08** Photomicrograph of epididymis from post-pubertal dog showing the lining epithelium Bm-Basement membrane, Bc-Basal cells, Pc-Principal cells, Sc-Stereocilia, Epi-Pseudostratified ciliated columnar epithelium H&E X 400

REFERENCES

- Archana, R.S., Katiyar, D., N. Sharma N. and M.M. Farooqui, .2008. Correlative anatomy of testes and epididymis in Gaddi goat (*Capra hircus*). Souvenir and Abstracts. S23rd Annual Convention of the Ind. Assoc. Vet. Anatomists. pp: 14.
- Bacha, W. J. Jr. and Bacha, C. M., 2000. In "Colour atlas of the veterinary histology" 2nd Edn. Lippincott Williams and Wilkins. A Wolters kluwer company 351 west Camden Street Baltimore. pp: 203-04.
- Bacha, W.J and L.M. S Bacha., 2000. Colour Atlas of Veterinary Histology. 2nd edn. Philadelphia, Lippincott, Williams and Wilkins. pp: 203-219.
- Bancroft, J.D., 2013. *Histochemical techniques*. Butterworth-Heinemann.
- Banks, W. J., 1993. In "Applied veterinary histology" 3rd edn. Mosby Year book St. Louis Baltimore, Boston, Chicago, London Philadelphia and Sydney Toronto. pp: 477-86.
- Cleland, K.W. 1957. The structure and function of the Epididymis. The histology of the Rat Epididymis. *Australian J. of Zoology*, 5(3): 223 - 246.

- Copenhaver, W.M., Kelly, D.E and Wood, R.L. (1978). *Bailey's Text Book of Histology*. 17th edn., The Williams and Wilkins Company. Philadelphia, USA. pp. 611-643.
- Dyce, K.M., W.O. Sack and C.J.G. Wensing, 2017. *Textbook of Veterinary Anatomy*, 4th edn. W.B. Saunders Company, Philadelphia. pp: 185, 578.
- Eurell, J. A. and Frappier, B. L., 2006. In “*Dellmann's Textbook of Veterinary Histology*” 6th edn. Blackwell publishing Ltd. 9600 Garsington Street Oxford OX42DQ, UK. pp: 233–245
- Eurell, J.A. and F.L. Brian, 2006. In “*Dellmann's Textbook of veterinary Histology*” 6th edn. Blackwell publishing Ltd. 9600 Garsington Street Oxford OX 42 DQ, UK. pp: 233-245.
- Evans, J.P., Wilson, A.J., Pilastro, A. and Garcia-Gonzalez, F., 2019. Ejaculate-mediated paternal effects: evidence, mechanisms and evolutionary implications. *Reproduction*, 157(4), pp.R109-R126.
- Fawcett, D.W., Neaves, W. B. and M.N. Flores, M.N., 1973. Comparative observation on intertubular lymphatics and the organization of the intertubular tissue of mammalian testis. *Biol. Reprod.*, 9(5): 500-532.
- Flickinger, C.J., S.S. Howards and H.F. English, 1978. Ultrastructural differences in efferent ducts and several regions of the epididymis of the hamster. *Am. J. Anat.* 152(4): 557-585.
- Franca, L., V.A. Silva junior V. A., C. H. Chiarini, C. H, Garcai, S. K. and L. Deheljuk L., 2000. Cell proliferation and hormonal changes during postnatal development of the testis in the pig. *Biology of Reproduction*. 63(6):1629–1636.
- Gaykee, D.E., H.S. Gabhane, R.U. Gajbe, U.P. Mainde and J. Raut, 2008. Microscopic study of epididymis in horse. *Souvenir and Abstracts. 23rd. Annual convention of Ind. Assoc. Vet. Anatomist.* pp: 23.
- George, F.W., catt, K.J., Nneaves, W.B. and wilson Wilson, J.D., 1978. Studies on the regulation of testosterone synthesis in the fetal Bengal goats. *Bangl. rabbit testis. Endocrinology*, 102 (3), pp.665-673.
- Getty, R., 1977. *Sisson and Grossman's the Anatomy of the Domestic Animals-II*. Publ.
- Girish, R., K. Kakade K., K.N.C Mouly, K.N.C. and R.V. Prasad R.V., 2001. Histology of the mediastinum testis and rete testis of the dog. *Ind. J. Anim. Sci.*, 71(2): 95-97.
- Gofur, M.R., M.Z.I. Khan, M.Z.I., M.R. Karim, M.R. and M.N. Islam, M.N., 2008. Histomorphology and Histochemistry of Testis of Indigenous Bull (*Bos Indicus*) of Bangladesh. *Bangl. J. Vet. Med.*, 6(1): 67–74.
- Gunes, S., Hekim, G.N.T., Arslan, M.A. and Asci, R., 2016. Effects of aging on the male reproductive system. *Journal of assisted reproduction and genetics*, 33(4), pp.441-454.
- H.D. Dellmann, H.D. and E.M. Brown., 1986. *Textbook of Veterinary Histology*. 3rd Edn. Lea and Febiger, Philadelphia. pp: 295-312.
- Hafez, E.S.E. and Hafez, B., 2000. Fertilization and cleavage. *Reproduction in farm animals*, pp.110-125.
- Hoffer, A.P., D.W. Hamilton, and D.W. Fawcett, 1973. The ultrastructure of the principal cells and intraepithelial leucocytes in the initial segment of the rat epididymis. *Anat. Res.*, 175 (2):169-201.
- Islam, M.N., M.L. Hossain M.L. and M.A. Quassam, M.A., 2002. Postnatal development of testis, epididymis and ductus deferens in Black Veterinarian. 19(2):129-138.
- Luna, L. G., 1968. In “*Manual of Histological staining methods of the Armed Forces Institute of Pathology*”. McGraw Hill Book Co., London. 3rd Edn. Pp :80 –171.

- Moustafa, L. A and E.S.E. Hafez, 1971. Prenatal development of the bovine reproductive system. *J. Reprod. Med.*, 7: 99–113.
- Nabeyama, A and C. P. Leblond, 1974. Caveolated cells” characterized by deep surface invaginations and abundant filaments in mouse gastrointestinal epithelia. *Am. J. Anat.*, 140(2): 147-165.
- Naidu, K.V., 1991. Studies on postnatal changes in reproductive organs and Plasma testosterone levels of madras Red rams maintained under grazing for feed lot systems. ph.D. thesis. Tamil nadu veterinary and Animal Sciences University, Chennai.
- Nishimura, S., K. Okano K., K. Yasukouchi K., T. Gotoh T., S. Tabata, S..and Iwamoto, H..2000. Testis developments and puberty in the male Tokara (Japanese native) goat. *Anim. Reprod. Sci.*, 64(1-2): 127–131.
- Parul, S., 2015. Prenatal study on the development of testis and epididymis of gaddi sheep. Phd. Thesis. Department Of Veterinary Anatomy, Chaudhary Sarwan Kumar Himachal Pradesh Krishi Vishvavidyalaya Palampur-176062 (H.P.), pp. 75-80.
- Paul, S.R., Debroy, B., Sarkar, B.K., Das, S. and Nandi, S., 2020. Histo-morphological studies of testis & epididymis of *Panthera leopercica*.
- Russe, I. and F. Sinowatz, 1991. Harn–und Geschlechtsorgane. In: *Lehrbuch der Embryologie der Haustiere*. Verlage Paul Parey. Berlin, Germany. Pp: 304–337.
- Sharma, K.K., R. Mathur, R, A. Joshi, A. and Y. P. Singh, 2011. Anatomy and Histology of the testes of the dog. XXVI annual convention of IAVA and National symposium: 2-4 Nov. 2011 held at Mathura: Souvenir cum abstracts. Pp: 8
- Trautmann, A. and J. Fiebiger, J., 2002. In “Fundamentals of the histology of domestic animals”. 1st Edn. Green
- Verma, R.P. and Sahni, K.L., 1997. *Textbook of Veterinary Andrology*. Vikas.
- White, D., J.G. Berardinelli, J. Gand K.E. Aune K.E., 2005. Age variation in gross and histological characteristics of the testis and epididymis in Grizzly bears. *Ursus*. 16(2): 190–197.
- Wrobel, K.H., 1972. Morphologie der Ductuli efferentes des Bullen. *Z. Zellforsch. Mikrosk. Anat.* 135(1): 129-148.
- Zade, B.A., 2007. Age related Histological and Histochemical Changes in Testis of Dog (*Canis Famillaris*). M.V.Sc. Thesis, Maharashtra Animal and Fisheries Sciences University, Nagpur.