

**Research Article**

**HISTOLOGICAL STUDIES ON EPIDIDYMIS REGION OF  
GOAT (*CAPRA HIRCUS*) REPRODUCTIVE SYSTEM**

**R.K. Sharma\*, A.K. Goyal and Yadav Veena**  
Reproductive Physiology Laboratory, Department of Zoology,  
Kurukshetra University, Kurukshetra-136119, India

**Article History:** Received 3rd June 2014; Accepted 16<sup>th</sup> June 2014; Published on 24<sup>th</sup> July 2014

**ABSTRACT**

The histoarchitecture of the epididymis region has been analyzed in goat, *Capra hircus*. The epididymal duct was internally lined by columnar epithelium and basement membrane followed by submucosa containing interstitium, encircled on outer side by an thick band circular muscles and feeble longitudinal muscles and outermost layer of serosa. Various types of cells were observed in the epididymis including the principal cells, narrow cells, basal cells and apical cells. The Principal cells are columnar cells which project their stereocilia into lumen. Narrow cells are the slender elongated cells present adjacent to the Principal cells. Basal cells are triangular and flat cells reside in the base of the epithelium. Apical cells are located toward the lumen. Other two types of cells i.e. Halo cells and Clear cells were not observed during present study.

**Keywords:** Histoarchitecture, Testis, Epididymal duct, Principal cells, Reproduction.

**INTRODUCTION**

The survival of a species largely depends on its ability to reproduce its own kind. Reproduction is a complex process involves series of events viz. gamete production, fertilization, gestation, reproductive behavior, lambing/kidding, etc. Sheep and goats are considered to be the most prolific of all domestic ruminants. A high rate of reproductive efficiency is important for perpetuation of the species, production of meat, milk, skin and fiber, and replacement of breeding stock (Abebe, 2001).

The male reproductive system of goat consists of testicles, which produce sperm and sex hormones, a duct system for sperm transport, accessory sex glands, and the penis. Today epididymis is no longer regarded as a mere conduit pipe for spermatozoa from the testis to the exterior but it serves a critical function by secreting important components of semen and in preparing the male germ cells for fertilization (Joseph *et al.*, 2009).

For implementing appropriate reproductive management, understanding basic anatomy and reproductive physiology of goat epididymis is a

must. Therefore present study on the gross histology of the epididymis in the goat (*Capra hircus*) was carried out. The information will provide the basis for future research on influence of endogenous and exogenous factors of this important part of reproductive tract.

**MATERIALS AND METHODS**

**Experiment Design:** The experiment animal tissue of goat (*Capra hircus*) procured from the slaughter houses near Kurukshetra and brought to the laboratory in culture media. After decapsulation the epididymis region was separated from testis and processed for in vitro experimental protocol. After washing with normal saline the tissue was fixed in aqueous Bouins fixative for 24 hours.

**Histological Slides:** After Bouins fixation the tissue was washed in running tap water for 6 hours. The specimen then was dehydrated in various grades of alcohol. After proper dehydration specimen was embedded in paraffin wax at 58-60<sup>o</sup>C. The tissue was sectioned serially at 5 µm thickness and the sections were stained with the Haemotoxylene and Eosin (H & E) Stain and Mercury Bromo Phenol (MBP) Stain.

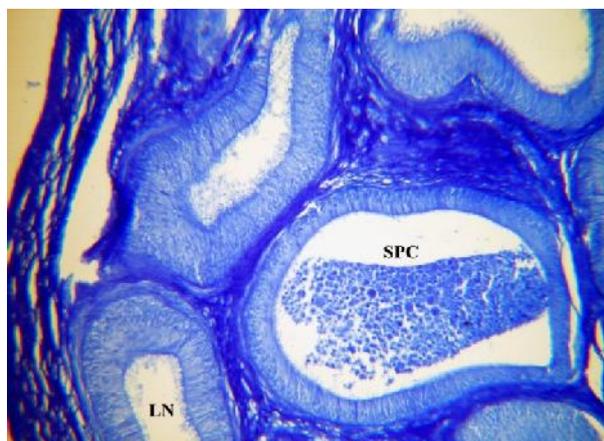
\*Corresponding author e-mail: rkskukz@gmail.com

For staining the slides were placed for 10 minutes in stain after deparaffinization and hydration through retrograde alcohol series, and allowed to develop the color for 5 to 15 minutes in tap water. After dehydration in 70% ethanol, the sections were stained with eosin (2% eosin in 70 % alcohol) for 1 to 2 minutes. The slide were washed in 70% ethanol and dehydrated in 90% and absolute alcohol and cleared in xylene and were mounted in DPX. Each section was examined under light microscope to study the histological characteristics of epididymis region of testis (Sharma *et al.*, 2014).

## RESULTS

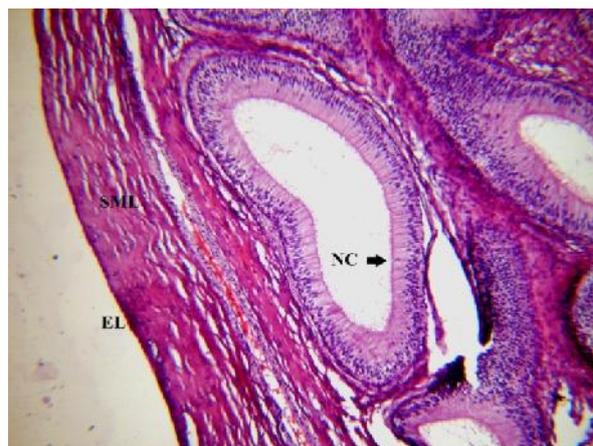
The epididymis as an epithelial tube is folded into a highly organized structure comprised of many segments that can be grouped into roughly five gross anatomical segments, namely: initial segment, caput, corpus, cauda, and vas deferens.

The epididymal duct is lined by epithelium. Various types of cells were observed in the epididymis including the principal cells, narrow cells, basal cells and apical cells. The luminal region filled with the sperms was also observed (Figure 1).



**Figure 1.** T.S. of epididymis showing Lumen (LN) and Sperm content (SPC). (MBP stain at 100X).

The epididymal duct was internally lined by columnar epithelium and basement membrane followed by submucosa containing interstitium, encircled on outer side by an thick band circular muscles and feeble longitudinal muscles and outermost layer of serosa (Figure 2).



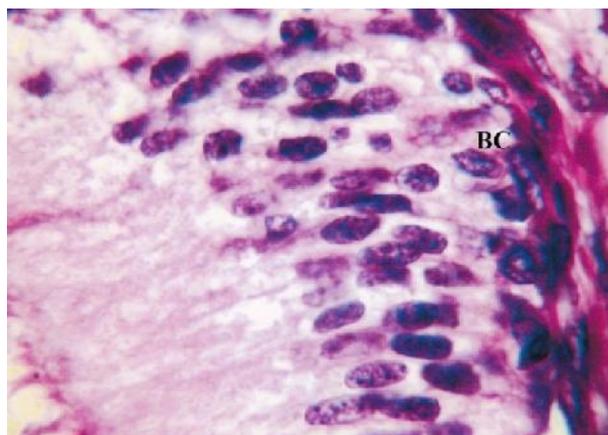
**Figure 2.** T.S. of epididymis showing epithelium layer (EL), smooth muscle layer (SML) and Narrow cells (NC). (H & E stain at 100X).

The principal cells are columnar cells extended from the basal lamina to the narrow lumen into which their stereocilia projected. The nuclei of these cells were oval to elongate in shape and were situated within the basal half of the cell (Figure 3).



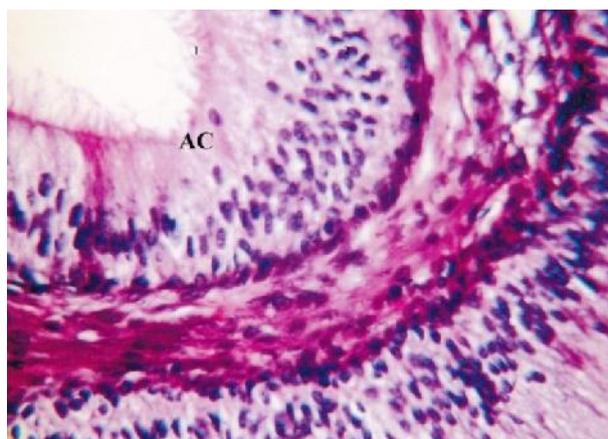
**Figure 3.** T.S. of epididymis tubule showing Principal cells (PC) and stereocilia (SC). (H & E stain at 1000X).

Narrow cells are the slender elongated cells present adjacent to the principal cells. These cells were narrower than the principal cells, attenuated, and send a thin process of cytoplasm to reach the basement membrane (Figure 2). Basal cells are triangular and flat cells and they reside in the base of the epithelium. They have elongated or round shaped nuclei, and they are in close association with the overlying principal cells (Figure 4).



**Figure 4.** T.S. of epididymis tubule showing Basal cells (BC) (H & E stain at 1000X)

Apical cells defined by the few microvilli at the luminal border and a nucleus that is located in the upper half of the cell cytoplasm (Figure 5). Other two types of cells i.e. Halo cells and Clear cells were not observed during present study.



**Figure 5:** T.S. of epididymis tubule showing Apical cells (AC) (H & E stain at 400X).

## DISCUSSION

During present investigation various types of cells were observed in the epididymis including the principal cells, narrow cells, basal cells and apical cells whereas other two types of cells i.e. Halo cells and Clear cells were not observed.

Earlier studies suggest that Principal cells comprise approximately 65% to 80% of the total epithelial cell population of the epididymis which is also observed during present study (Trasler *et al.*, 1988). Principal cells synthesize a large number of proteins that are then either retained in the cells or actively secreted into the luminal compartment (Robaire and Hermo, 1988). They also play an active role in endocytosing proteins found in the luminal

compartment of the epididymis (Hermo *et al.*, 1994).

In our study narrow cells was found to located near the Principal cells. Similar cells have also been reported in the same regions in numerous other species, including bovine, hamster, echidna, and human (Flickinger *et al.*, 1978; Robaire *et al.*, 2006).

Basal cells appear in all species studied to date, including humans supported by our work (Hamilton, 1975). It has also been proposed that basal cells may have a role as immune cells because of their ability to respond in number and macrophage antigen expression to the presence of sperm autoantigens in the lumen (Seiler *et al.*, 2000).

Earlier work revealed that the apical cells were found primarily in the epithelium of the initial segment and intermediate zone which was supported by the current study (Sun and Flickinger, 1980). These cells have the ability to endocytose substances from the lumen (Adamali *et al.*, 1999).

Halo cells are small cells with a narrow rim of clear cytoplasm that are located in the base of the epithelium where it does not touch the basement membrane (Robaire and Hermo, 1988). During present study these cells were not seen in histological sections. These cells contain variable numbers of dense core granules. These cells have role in immune function (Hamilton, 1972).

Clear cells were generally found to present along with halo cells was not observed during present study (Robaire and Hermo, 1988). Clear cells involved in endocytose number of different proteins in a region-specific manner (Vierula *et al.*, 1995).

## CONCLUSIONS

The epididymis promotes the modifications of the spermatozoa that are necessary for the spermatozoa to become fertilization-competent cells and to be stored safely in the male reproductive tract. The present study opines that epididymal duct is lined by epithelium and the duct contains tubular regions in which various types of cells including the principal cells, narrow cells, basal cells and apical cells. Since epididymal dysfunctions are related to cases of idiopathic male infertility, the present study was conducted to establish a baseline of histology of

goat epididymis on which further research can be based.

### CONFLICT OF INTEREST

The authors declare that there are no conflicts of interest associated with this article.

### ACKNOWLEDGEMENTS

The authors are grateful thankful to the Professor and Head, Department of Zoology, Kurukshetra University for the laboratory facilities provided.

### REFERENCES

- Abebe, G., 2001. Reproduction in Sheep and Goats. Ethiopia Sheep and Goat Productivity Improvement Program. Chapter 5, pp: 59-79.
- Adamali, H.I., Somani, I.H., Huang, J.Q., Mahuran, D., Gravel, R. A., Trasler, J. M. and Hermo, J.L., 1999. Abnormalities in cells of the testis, efferent ducts, and epididymis in juvenile and adult mice with beta-hexosaminidase A and B deficiency. *J. Androl.*, 20: 779-802.
- Flickinger, C.J., Howards, S.S. and English, H. F., 1978. Ultrastructural differences in efferent ducts and several regions of the epididymis of the hamster. *Am. J. Anat.* 152: 557-586.
- Hamilton, D.W., 1972. The mammalian epididymis. In: Reproductive Biology (H. Balin and S. Glassner, Eds.), Excerpta Medica, Amsterdam, pp: 268-337.
- Hamilton, D.W., 1975. Structure and function of the epithelium lining the ductuliefferentes, ductusepididymidis and ductus deferens in the rat. In Handbook of Physiology (R. O. Greep and E. B. Astwood, Eds.), Sec. 7, Vol. 5, American Physiological Society, Washington, DC, pp: 259-301.
- Hermo, L., Oko, R. and Morales, C.R., 1994. Secretion and endocytosis in the male reproductive tract: a role in sperm maturation. *Int. Rev. Cytol.* 154: 106-189.
- Joseph, A., Yao, H., Hinton, B.T., 2009. Development and morphogenesis of the Wolffian/Epididymal duct, more twists and turns. *Developmental Biol.*, 325: 6-14.
- Robaire, B. and Hermo, L., 1988. Efferent ducts, epididymis and vas deferens: structure, functions and their regulation. In: The Physiology of Reproduction (E. Knobil and J. Neill, Eds.), Raven Press, New York, pp: 999-1080.
- Robaire, B., Hinton, B.T. and Orgebin-Crist, M. C., 2006. The Epididymis. In: Knobil and Neill's Physiology of Reproduction, Chapter 2, Third Edition (eds. Jimmy D. Neill, Tony M. Plant, Donald W. Pfaff, John R.G. Challis, F.R.S.C., David M. de Kretser, M.D., A.O., JoAnne S. Richards, and Paul M. Wassarman), Elsevier Publication, pp.1071-1148.
- Seiler, P., Cooper, T. G. and Nieschlag, E., 2000. Sperm number and condition affect the number of basal cells and their expression of macrophage antigen in the murine epididymis. *Int. J. Androl.*, 23: 65-76.
- Sharma, R.K., Goyal A.K., Thareja, K., Bhat R.A., 2014. Effect of nano molar concentration of methyl parathion on goat testis. *Int. J. Pharm. Pharmaceut., Sci.*, 6(2): 200-202.
- Sun, E.L. and Flickinger, C.J., 1980. Morphological characteristics of cells with apical nuclei in the initial segment of the adult rat epididymis. *Anat. Rec.*, 196: 285-293.
- Trasler, J.M., Hermo, L. and Robaire, B., 1988. Morphological changes in the testis and epididymis of rats treated with cyclophosphamide: a quantitative approach. *Biol. Reprod.*, 38: 463-479.
- Vierula, M.E., Rankin, T.L. and Orgebin-Crist, M.C., 1995. Electron microscopic immunolocalization of the 18 and 29 kilodalton secretory proteins in the mouse epididymis: evidence for differential uptake by clear cells. *Microsc. Res. Tech.*, 30: 24-36.