POSTNATAL DIFFERENTIATION OF SPERMATOGENIC CELLS IN THE TESTIS OF RAM*

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ABSTRACT

At birth, and up to three months of age, the sex cords showed only two types of cells. The numerous small cells were seen along the periphery of the sex cords on the inner surface, whereas the few large cells were seen either between the small cells or located in the interior between the small cells and the un-segmented central ground substance that filled the interior of the sex cord. The small cells differentiated and formed the spermatogenic and supporting cells whereas the large cells took up the function of the supporting cells till they degenerated. At five months of age, the nucleus of these small cells showed the characteristics of spermatogonia. At six months of age, primary spermatocytes appeared first. They later divided to form secondary spermatocytes. These were observed at seven months of age. From the end of the eighth month and in the ninth month of age, the round and elongated spermatids and the spermatozoa made their appearance.

Key words: Sex cords, Spermatogenic cells, Differentiation

INTRODUCTION

The seminiferous tubules in the testis of any species consist of the highly specialized epithelium made up of germinal cells and supporting (Sertoli) cells. The different generations of the germinal cells are spermatogonia, spermatocytes, spermatids and spermatozoa. The cellular arrangement is characteristic for each species. The continuous process of differentiation of the male germ cells is a complex process, which involves a stage of proliferation of cells, a stage of nuclear events, which characterize the meiotic process and finally, a stage of differentiation events, which transform the spermatids into the mature spermatozoa (Burgos et al., 1970). The present study elucidates the postnatal differentiation and arrangement of these spermatogenic cells in the seminiferous tubules of ram from birth to maturity.

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MATERIALS AND METHODS

The present study was undertaken using the samples obtained from sixteen Madras Red rams in the Chennai Corporation abattoir. The tissue pieces of testis were obtained immediately after slaughter. The rams used were divided into four age groups viz; pre-weaning (birth to 3 months), pre-pubertal (4 to 6 months), pubertal (7 to 9 months) and post-pubertal (10 to 12 months), each of which consisted of four animals. The determination of age was ascertained based on the eruption of teeth (Noden and de Lahunta, 1985). The tissue pieces collected were fixed in 10% neutral buffered formalin and Bouin’s solution. Sections of 5-6 µm thickness were cut and stained by the Haematoxylin and Eosin method and the Alcian blue - Periodic acid Schiff (PAS) technique (Luna, 1968).

RESULTS AND DISCUSSION

At birth, and up to three months of age, the sex cords showed only two types of cells. The numerous small cells were seen along the periphery of the sex cords on the inner surface, whereas the few large cells were seen either between the small cells or located in the interior between the small cells and the un-segmented central ground substance that filled the interior of the sex cord. On the contrary, Baishya et al. (1987) reported that in the testis of Assam goats, aged from zero to ninety days, the germinal epithelium of the seminiferous tubules consisted of gonocytes and pre-spermatogonia up to 60 days. Beyond this age, the further developmental stages viz., spermatogonia and primary spermatocytes were seen. Spermatogonia were first seen at sixty-nine days of age and this was considered the initiating age of spermatogenesis in Assam goat.

In the present study, some of the large cells showed degenerative changes from three months onwards. The small cells showed the two morphological variations at four months of age. Cells with round nuclei were characteristic of spermatogenic cells, whereas those with irregular nuclei were characteristic of sustentacular cells. The small cells differentiated and formed the spermatogenic and supporting cells whereas the large cells took up the function of the supporting cells till they degenerated, as the small cells were still undifferentiated till then (Fig. 1). These observations are in accordance with the description of Santamaria and Reece (1957) in bull, Fossland and Schultze (1961) in bovine, Goyal (1971) in buffalo, Reddy (1983) in goat and Naidu (1991) in ram. On the contrary, Clermont and Perey (1957) in rat, Thomas and Raja (1980) in pig, Curtis and Amann (1981) in bull, Raja (1981) in crossbred bull and Monet-Kuntz et al. (1984) in lamb, reported that the large gonocytes gave rise to the definitive germ cells.

In the present study, the nucleus of these small cells showed the characteristics of spermatogonia at five months of age. The primary spermatocytes first appeared at six months of age (Fig. 2). They later divided to form secondary spermatocytes. These were observed at seven months of age. From the end of the eighth month and in the ninth month of age, the round and elongated spermatids and the spermatozoa made their appearance (Figs. 3 and 4). These findings and the reports of
different authors were varied. While Skinner et al. (1968) reported the presence of spermatozoa in the tubules of rams, at 112 days of age, Aire (1973) reported that all ram lambs aged 20-24 weeks had mature spermatozoa in their seminiferous tubules. Similarly while Monet-Kuntz et al. (1984) reported that by 100 days of age, round spermatids were observed in only half of the lambs studied, Ali (1988) reported that at 210 days of age, spermatozoa were seen attached to the Sertoli cells and at 240 days of age, the lumen showed clumps of spermatozoa in the Deccani ram.

The finding in the present study is in partial agreement with the report of Naidu (1991) who observed that the spermatids and spermatozoa were seen at 210 days of age in lambs maintained under feedlot system whereas in lambs left for grazing, they appeared at 240 days of age. Nishimura et al. (2000) opined that in the male Tokara goat, large numbers of spermatozoa were always present in seminiferous tubules from 4 months of age. Islam et al. (2002) reported that in the Black Bengal goat, the seminiferous tubules in the 180 day-old buck contained spermatids but not spermatozoa in the lumen and at 720 days numerous spermatozoa were seen in the lumen.

All these variations reported by different authors were probably due to the species and breed characteristics and also probably due to the different management conditions and practices during early postnatal growth.

REFERENCES


Postnatal differentiation...


LEGENDS FOR PHOTOMICROGRAPHS

Fig. 1: Photomicrograph of the testis in four month-old ram showing the spermatogonia
- So - Solid sex cords
- SG - Spermatogonia
- Lu – Lumen
- BM – Basement membrane
- I - Interstitial tissue
- L - Large cell

Alcian blue - PAS x 400

Fig. 2: Photomicrograph of the testis in six month-old ram showing the different cells
- SG - Spermatogonium
- PS – Primary spermatocyte
- ST – Seminiferous tubul
- Lu – Lumen
- Le – Leydig cell

H & E x 200

Fig. 3: Photomicrograph of the seminiferous tubule in the testis of a nine month-old ram showing the different cells
- ES – Elongated spermatids
- NS – Newly formed spermatids
- A – Type A spermatogonium
- B – Type B spermatogonium
- Z/P – Zygotene/ Pachytene stage

PAS x 630

Fig. 4: Photomicrograph of the seminiferous tubule in the testis of a nine month-old ram showing the different cells
- PL – Preleptotene stage
- L - Lumen
- A – Type A spermatogonium
- B – Type B spermatogonium
- RB – Residual bodies
- Sp – Spermatozoa
- P – Pachytene stage
- S – Sertoli cell
- Bm – Basement membrane

PAS x 630