Morpho-histological Studies on the Male Genital Apparatus of Chinchilla laniger

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Abstract
The histological studies of the male genital apparatus of the Chinchilla Laniger are scares and incomplete. Due to the studies done on the male genital apparatus of Chinchilla Laniger it has been determined that the seminiferous tubes are separated by large conjunctive septum; the seminiferous epithelium varies from one tissue to another, aspect that suggests different stages in the spermatogenesis process. The epididymis channel is made up of pseudo-layered epithelium, a reduced lamina propria and a delicate muscular layer. The deferent channel wall is made up of three tunics: mucous, muscular and adventitia. The muscular tunic is the most developed part and is made up of three super posed layers of even smooth muscle cell. The histological sections done on the pelvic urethra reveals the following components: mucous, vascular layer, muscular and adventitia. The transversal sections done on the free extremity of the penis reveal the presence of the foreskin made up of three layers: tegument or external, parietal or visceral. The vesicular glands (seminal) have an intestine shaped aspect and are sustained by their own ligament, richly vascularised. The transversal section reveals a tubular aspect, the wall of these tubes is made up of: mucous, muscular and adventitia. The prostate is made up of an external part and an internal part, and is covered in a thick conjunctive-muscular capsule.

Keywords: Chinchilla laniger, histological study, male apparatus.

1. Introduction

The male genital apparatus of Chinchilla Laniger is made up of: testes, genital ductus (epididymis, deferent channel, ejaculation channel and urethra), copulative organ (penis) and accessory glands (prostate and seminal glands).
The **testes are** twin organs, relatively small (3-5g). Until puberty they are kept in the inguinal channel, and afterwards they descend in the testicular bursa (bursa testicularis). Due to the testicles orientation to the great vertical axis and the strong cremaster muscle, they are slightly elevated in the abdominal cavity and descended in the testicular bursa.
The **urethra** is an unpaired channel and has urinary and genital function. Its trajectory can be split into two parts: pelvic and extrapelvic. The pelvic urethra is relatively short. The extrapelvic urethra exits the pelvis and is placed in the ventral pit of the cavernous body of the penis. It ends with the external urethral opening [1]. Through the merging of the extrapelvic urethra with the cavernous body results the penis, the male copulative organ, whose free extremity is sheltered in a skin fold called foreskin [2].
The penis is 6-7 cm long. The cranial extremity of the free part of the penis is covered in a tegument with stratified squamous epithelia, oriented towards the penis base. During idle period, the

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penis is sheltered in an abdominal skin fold, called slip [3].
The penis is made up of a fix part that stretches from the penis root up to the end of the foreskin cavity, and a free part, that starts at this level and stretches to the gland.
The penis body is made up of the cavernous body and urethra surrounded by the spongious body [4]. The last one presents more parts: the spongious body of the penis, the spongious body of the gland and the spongious bulbs. The penis structure also has muscles, blood and lymphatic vessels, nerves and the free skin part. The copulation function is possible due to the two types of erectile tissue: the spongious body and the cavernous body.
The cavernous body of the penis comes from the merging of the median line of two cylindrical bodies which are independent mostly on the penis root level, where they split in two branches that are inserted separately on the ischial arch [5].
The spongious body of the penis is disposed around the urethra in the urethral pit of the cavernous body. Its body is uniform except the extremities which are more expanded, having large specific variations.
On the penis posterior extremity the spongious body has a new expansion called the spongious body of the gland, which covers the forked top of the cavernous body and makes up the anatomical base of the gland.
The intimate mechanism of the erection is based on the common principle of liquid uncompressibility which flood the cavernous and spongious tissue through two systems: active hyperemia and passive hyperemia [4].
The penis' muscles have the role to steer the penis during copulation, compress the discharge veins for a stronger erection, and accelerate the spermatic liquid during ejaculation, the compression and retreat of the penis in the slip after copulation. The most important penis muscles are: ischio-cavernosus and the retractor.
The **accessory glands** of the chinchilla male genital apparatus are represented by the prostate and the seminal glands, lacking the bulbourethral glands [1]. The volume of an ejaculate is of 0.1 – 0.5 ml and contains between 20-200 million sperm which move at a speed of 25 mm in 4 minutes.
The objective of this study was to point out the histological particularities of the essential organs and the genital tracks of Chinchilla and their implications in the manifestation of the reproductive function on this species.

2. Materials and methods

The biological material has been represented by 12 healthy adult males from the Chinchilla Laniger species, procured from the SC Falnic SRL farm in Timisoara, Romania. Samples from the testicles, epididymis, deferent channel, urethra, penis, prostate and seminal glands have been taken from each animal. They were euthanized with an overdose of ketamine administered intramuscularly. Histological preparations have been made by the method [5]. The images were taken using an IOR binocular microscope.

3. Results and discussion

The male genital apparatus of Chinchilla is made up of gonads (testicles), genital tracks (epididymis, ductus deferent, ejaculator channel, intra and extra pelvis urethra), accessory glands (seminal glands, prostate) and the copulative organ (penis).

Testicles

The testicles are organs, with globular aspect, slightly oval and white-pearl colour, disposed in the abdominal cavity. From the anatomical point of view, the description is as follows: two sides (back and ventral), two edges (epididymis and free) and two extremities (cranial and caudal). Due to the transparent and delicate albuginea, on the free edge there is the testicular artery, with a sinuous track which splits into little and straight branches on both sides of the testicle. The branches of the testicular artery do not go as far as the epididymis edge [6].
The testicular parenchyme is soft and covered in a thin white albuginea on the exterior. The microscopic study done on the fix histological prepared (transversal sections), reveals the presence of the albuginea on the organ exterior part. The albuginea is made up of collagen fibres, rare elastic fibres and a small number of fibroblasts. The seminal tubes (Figure 1) have a narrow lumen and are separated by large conjunctive septum. Peritubulary, under the base membrane of the polymorph epithelium that covers each tube, there are many blood capillaries

built-in in the conjunctive tissue made up of collagen fibres and even smooth muscular cell. The seminal epithelium varies from tube to tube, aspect that generates different stages of the spermatogenesis process [7]. On the base membrane of the seminal tubes there are disposed, on one line, the spermatogonies, spherical cells with central, spherical nucleus with a delicate granular chromatin. They have an intense basophile cytoplasm and are mitotic active, being the stem cells of the seminal line.

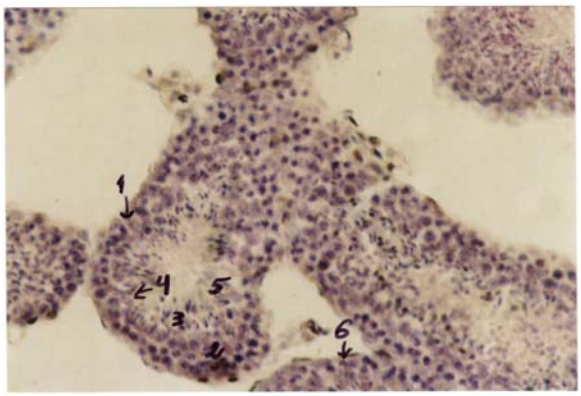

Figure 1. Chinchilla. Section through seminiferous tubules (HE 40X): 1 – spermatozoons; 2- spermatium I; 3 - spermatium II; 4 – spermatid; 5 – spermatozoans; 6 – peritubular capilary

On top of the spermatogonies there are disposed on three lines the primary spermatocyte. These are the biggest cells in the seminal epithelium, with a spherical, heterochromatic nucleus. These cells are often in metaphase.

While in some tubes, over the primary spermatocyte there are disposed rare spermatides and spermatozoa, for the majority of the tubes, the seminal epithelium is complete. Therefore, over the primary spermatocytes there are disposed a few lines of secondary spermatocytes, spermatides and many spermatozoa disposed on the apical pole of the epithelium.

Frequently, in the seminal tubes there are only spermatogonies, primary spermatocytes, secondary spermatocytes and spermatides (Figure 2).

The aspects observed on the seminal tubes' level suggest different stages of the spermatogenesis process. Inter-tubular, there are from place to place groups of polygonal cells, organised in cords near by the blood capillaries and which belong to the Leydig interstitial gland.

Epididymis

The epididymis is situated on the epididymal edge of the testicle and has a head, body and a tail. The head is tightly attached to the cranial extremity of the testicle, the body is attached to the epididymal edge of the testicle through a short ligament coming from the testicular ligament, and the tail is situated on the caudal extremity of the testicle, is detached from it and continues with the deferent channel [6]. For chinchilla, the epididymis is not uniformly developed on its entire length; the head and tail cover only partially the two testicular extremities (cranial and caudal). The most developed part is the tail.

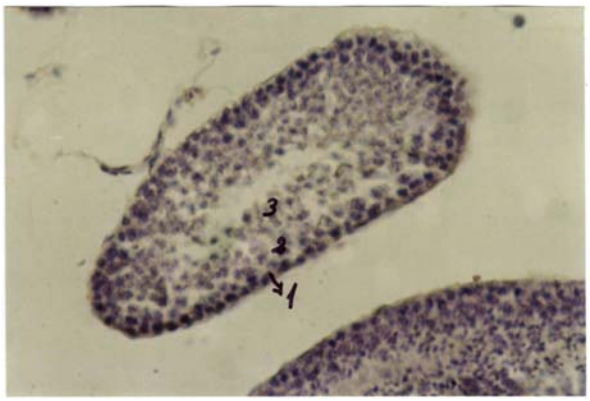

Figure 2. Chinchilla. Section through seminiferous tubules (HE 40X): 1 – spermatozoons; 2 – spermatium I; 3 – spermatium II

On fix histological prepares it can be found the epididymal duct, enlarged in the tail region (Figure 3).

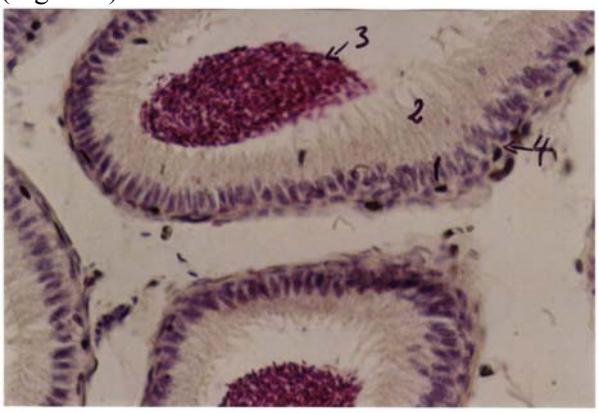

Figure 3. Chinchilla. Section through epididymis tail (HE 40X): 1 – epithelium; 2 – spermatozoans, 3 – connective tissue; 4 – capillary blood

On a microscopic level the epididymal duct is made up of a pseudostratified layered epithelium with rigid cilia on the apical pole (Figure 4), a reduced lamina propria and a delicate muscular layer made up of even smooth muscular cells. On the exterior it is covered in conjunctive tissue in

which there are collagen fibres, fibroblasts and many large lumen blood capillaries.
The microscopical images done on the three segments of the epididymis, reveal, as in other mammals, the great calibre of the epididymal duct on the tail level, suggesting the role of this segment of depositing the spermatozoa, ensuring the possibility of more ejaculations.

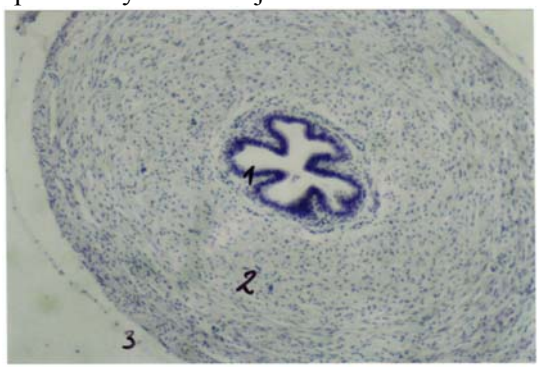

Figure 4. Chinchilla. Vas deferens (HE 10X; 10X): 1 – mucosa (a-epithelium, b-chorion); 2- musculare; 3 – adventitia

Ductus deferens (ductus deferens)
The ductus deferens continues the epididymis in caudal way, and together with the testicular vascular-nervous cord, forms the testicular cord. It has three parts: vaginal, abdominal and pelvic (terminal), which are placed under the prostate where it merges with the excretion channel of the seminal vesicles, forming the ejaculation channel which opens in the urethra.
In section, the deferent channel wall is made up of three tunics: mucosa, tunica muscularis and adventitia. The mucous is made up of the epithelium and lamina propria and presents a series of longitudinal folds.
The epithelium is pseudo-layered, having in its structure two types of cells: tall or columnar, with oval nuclei disposed on the basal part of the cytoplasm, and small cells, with spherical nucleus, basophile, disposed on the basal membrane having a role of replacing the columnar cells. From place to place, the columnar cells may have at their apical pole rare rigid cilia. In the lumen of the organ there are rare spermatozoa (Figure 5).
Among the cells of this epithelium there may be leukocyte cellular elements having a local defence role, but actually being on migration toward the organ lumen.
The lamina propria is well represented being made up of conjunctive tissue in the structure of which participate many elastic fibres, collagen fibres and a heterogenic cellular population (fibroblasts, poly-nuclear and mono-nuclear leucocytes). The capillary network is also well represented.
The muscular tunic is the most developed part of the deferent channel wall. It is organised in three layers of even superposed smooth muscular cell with different orientation: in the internal-longitudinal layer, the circular middle layer and the longitudinal external layer. The even smooth muscular cell in the structure of the three layers has a spindly aspect, slightly elongated, cane shaped and heterochromatic. The adventitia is made up of lax conjunctive tissue, enclosing many blood capillaries.

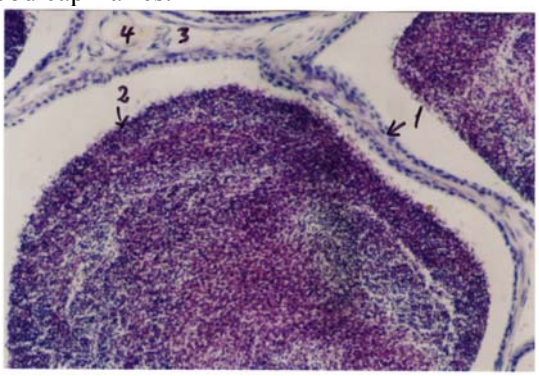

Figure 5. Chinchilla. Section through the epididymis (HE 40X): pseudostratified epithelium; 2 – rigid cilia; 3 – spermatozoans, 4 – capillary

Urethra
The urethra is a common genital-urinary conduct, and is made up of two segments: pelvic urethra, which starts from the neck of the urinary bladder and ends at the ischiatica arcade, and the extrapelvic urethra (penile portion), which starts from the ischial arch and ends at the penis extremity where it opens through the external urinary meat [8]
On the back side of the pelvic urethra there are the annex glands of the male genitalia.
The histological sections done on the pelvic urethra reveal that it is made up of the following: mucosa, vascular layer, muscularis and adventitia.
The mucous forms a series of longitudinal folds (Figure 6) and it is made up of epithelium and lamina propria. The urethral mucous epithelium is transitional multilayered and the lamina propria is made up of conjunctive tissue with predominant elastic fibres. The vascular layer is the most developed part of the organ and is represented by a strong venous plexus. Among the blood vessels there are conjunctive tissue blades made up of

collagen fibres, fibroblasts, blood capillaries and even smooth muscular cell.

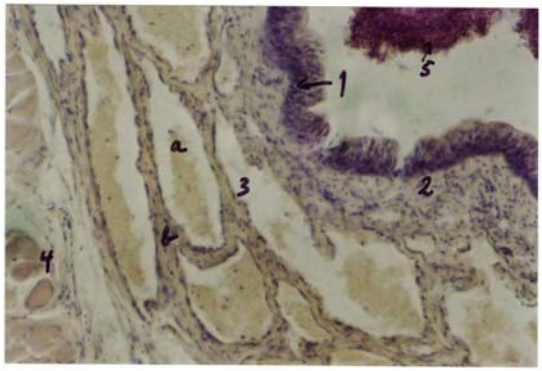

Figure 6. Chinchilla. Intrapelvic urethra (HE 40X): 1 – epithelium; 2 – chorion; 3 – vascular layer (a-vessels, b-connective tissue); 4 – muscular; 5 – spermatotoans

The transversal sections done on the penis reveal the structure of the extrapelvic urethra: mucosa, vascular layer, muscularis and adventitia (Figure 7).

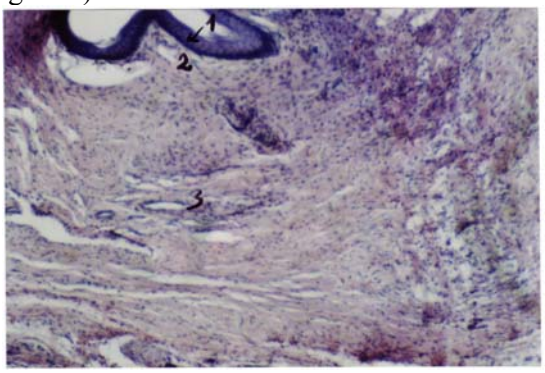

Figure 7. Chinchilla. Extrapelvic urethra (HE 10X): 1 – epithelium; 2 – chorion; 3 – sponge body

The transversal sections done on the free extremity of the penis reveal the foreskin presence, a tegument conduct made up of three layers: tegument or external (the skin fold), parietal (the penetration of the tegument layer toward the interior) and visceral, that covers the penis gland (Figure 8). The tegument layer is covered on the exterior by a pavimentous multilayered epithelium, under which there is a thick layer of conjunctive tissue made up of many unsorted collagen fibres, fibroblasts, even smooth muscular cells isolated or in fascicles and many large lumen capillaries. Also, from place to place, there are delicate hair and many sebaceous and sweat glands. The parietal layer of the foreskin also has a pavimentous multilayered epithelium, under which there is a thin layer of conjunctive tissue around which there is a even muscular layer with circular orientation.

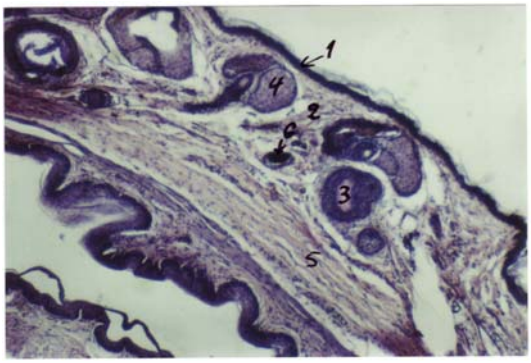

Figure 8. Chinchilla. Free end of the penis, tegumentary layer (HE 10X; 10X): 1 – multistratified squamous epithelium; 2 – connective tissue; 3 – hairs; 4 – sebaceous glands; 5 – muscle bundles; 6 – sweat glands

Between the parietal and visceral layer of the foreskin there is a conduct (Figure 9).

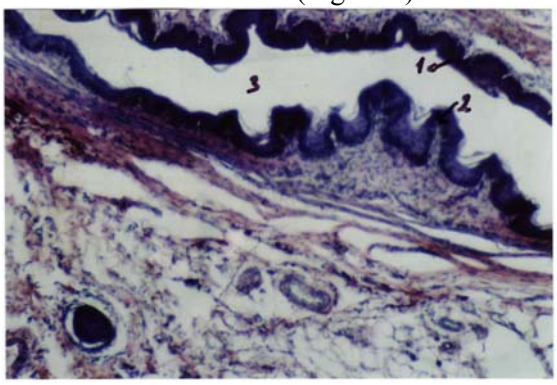

Figure 9. Chinchilla. Free end of the penis-foreskin (HE 10X) – parietal and visceral layer:1 – parietal epithelium layer; 2 – visceral epithelium layer; 3 – pipe

Vesicular glands (seminal vesicles)

The vesicular glands are two and they are placed on the side of the urinary bladder's neck and of the deferent channels [8]. The vesicular glands of chinchilla have an intestine shape of white-pearl colour, with many sack or finger shaped diverticula, emanated from the tubular part. The transversal sections reveal the tubular aspect of these glands, their wall being made up of mucosa, muscularis and adventitia.

The tubes are covered in a mucous that generates a series of simple or branch folds, with a role in increasing the secretion surface of the gland. The folds can anastomosis, generating separate cavities

through the thin walls that open in the large lumen of the gland.
The mucous is made up of a lamina propria and an epithelium. The epithelium is prismatic single layered, made up of tall secretion cells with oval nuclei and delicate granular chromatin. On the base line, among the secretion cells, there are rare cubic cells with round nuclei that are replacement cells for the secretion cells.
The muscular tunic is made up of two even muscular layers: internal, more developed with circular orientation and external, with longitudinal orientation.

Prostate

The prostate is made up of an external part (the body) and an internal or disseminated part. The external part is made up of two lobes (left and right), united by an isthmus disposed transversally on the back part of the vesicle-urethral junction.
The gland is covered in a thick conjunctive-muscular capsule from which come conjunctive septa which penetrate toward the interior delimitating the prostatic lobes made up of secretion alveoli and covered in a prismatic single layered epithelium.

Conclusions

After histological study of the segments of the male genital apparatus of the chinchilla conclusion is that these structures do not present significant differences in comparison with other mammals.
As a particularity of this species the vesicular glands are intestine shaped and are sustained by their own ligament, richly vascularised. The transversal sections reveal the tubular aspect, their wall being made up of mucosa, muscularis and adventitia.

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