Prenatal Development of Vas Deferens in Goats (Capra hircus)

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Received: 20 March 2013; Accepted: 19 May 2013

ABSTRACT

The anatomical studies on vas deferens of 60 goats embryos/foetii ranging from 30 days to full term were conducted. The demarcation between the epididymis and the vas deferens was observed at 60th day of gestation. After 98th day, the vas deferens had extra abdominal and abdominal parts. Microscopically, it was lined by simple columnar epithelium with a very small lumen at 66th day of gestation which showed slight tendency of pseudostratification at 86th day. The longitudinal mucosal folds were observed after 125 days. The luminal border of epithelial cells showed intense reaction for PAS, acid mucopolysaccharides and alkaline phosphatase. Lipid granules were observed in various parts of epithelial cells. Lamina propria and tunica muscularis could not be separable up to 77th day of gestation. At 84th day of gestation, the terminal part of vas deferens showed the dilatation, the ampulla, which was lined by high-pseudostratified columnar epithelium with few basal cells. The primordium of ampullary glands was noticed at 144th day of gestation.

Key words: Goat, Prenatal, Vas deferens

The vas deferens is the tubular structure which transports spermatozoa from epididymis to the urethra. The ampullated part of the vas deferens contained tubuloalveolar glands (Archana, 2006) during postnatal stage. The studies on the prenatal development of vas deferens is scanty, therefore the present paper records the prenatal development of vas deferens in goat.

MATERIALS AND METHODS

The present study was conducted on the 60 foetii ranged from 30 days to full term collected from healthy goats slaughtered at local abattoir. Each foetus was measured for its crown rump length in centimeters with the help of a nylon tape and weighed in grams on analytical balance. The approximate age was computed according to the formula derived by Singh et al. (1979) in goat. These foetii were divided into five groups viz; Group-I (30-60 days), Group-II (61-90 days), Group-III (91-120 days) and Group-IV (121-till term of gestation). The sex of foetii was determined by the appearance of genital swelling, anogenital raphae in I group whereas, in other groups by the development of penis and scrotal sac. The complete male genetalia was collected and the formation of vas deferens was recorded at various stages. The small pieces of the tissues were collected from different parts of the vas deferens and fixed in 10 per cent neutral buffered formalin. The tissues were processed by routine paraffin embedding technique. The sections (5-6 µ) were stained with hematoxylin and eosin, Wilder’s reticulin stain for reticular fibres, Weigert’s resorcin fuchsin stain for elastic fibres, PAS for glycogen, Alcian blue for acidic mucopolysaccharides (Luna, 1968), Mallory’s triple stain (Crossman’s modification, 1937) for collagen fibres, Modified Gomori’s calcium method for alkaline-phosphatase and Gomori’s lead method for acid phosphatase demonstration (Bancroft and Stevens, 1971).

RESULTS AND DISCUSSION

Macroscopic Anatomy

The demarcation between the future epididymis and the vas deferens was distinct at 60th day of intrauterine life due to the formation of cauda epididymis. The duct ran obliquely downward and backward on 57th day and crossed the neck of the bladder. It was related laterally with the ureters and opened into the dorsal wall of the urethra. Noden and de Lahunta (1985) in domestic animals opined that the caudal portions of the mesonephric duct below epididymis remained straight and became the vas deferens. On 78th day, the vas deferens ran inward, slightly forward, upward and then curved backward and opened into the urethra. At 84 days, the part of the vas deferens running parallel on the dorsal surface of the urethra became fusiform to form the ampulla. On 88th day of gestation, the vas deferens was placed on the caudo-medial aspect

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of testis parallel to the corpus epididymis.

Between 89-96th day of gestation, the vas deferens was present in the inguinal canal along with the testis. It crossed the internal inguinal ring and reached the dorsal surface of the urinary bladder enclosed in genital fold and entered in pelvic urethra (Fig. 1). After 98 days, due to descent of testis, the vas deferens had extra abdominal and abdominal course. The ampulla of the vas deferens in the initial part of pelvic urethra was almost covered by the seminal vesicles in IV group (121 days-till term).

In group II (91-120 days of gestation), the overall mean length and diameter of the left vas deferens were 16.60±3.39 and 0.48±0.02 mm, respectively and the respective values for the right duct were 14.30±3.30 and 0.47±0.02 mm. The mean length and diameter of the left ampulla were 2.64±0.11 and 0.94±0.11 mm, respectively. The right ampulla was 2.61±0.13 mm long and 0.84±0.14 mm in diameter. Group III, the overall mean length of the left vas deferens was 48.65±4.18 mm while right one was 48.60±3.96 mm long. Overall mean length and diameter of left ampulla were 7.85±0.33 and 0.91±0.12 mm, respectively. Respective values for the right ampulla were 7.8±0.33 and 0.91±0.12 mm. In group IV (121 days-till term), the mean length of left and right vas deferens was 76.41±7.66 and 76.02±7.77 mm, respectively. The mean diameter of the left vas deferens was 1.03±0.13 mm while right one was 1.03±0.13 mm in diameter. The length and diameter of the left ampulla were 12.92±1.52 mm and 1.53±0.13 mm, respectively and that of right ampulla were 10.75±2.22 and 1.53±0.13 mm, respectively.

Microscopic Observations

Non-ampullated part of vas deferens: In group I, at 56th day of gestation, the vas deferens was lined by simple columnar epithelium with narrow lumen. The cytoplasm of the cells was highly eosinophilic with spherical or elongated and darkly stained nuclei. The duct was surrounded by closely packed mesenchymal mass. Discontinuous basement membrane was highly acidophilic. In group II, at 66 days it was lined by simple cuboidal to columnar epithelium with a very small lumen surrounded by closely packed concentrically arranged mesenchymal cells (Fig. 2). The height and width of the epithelial cells ranged from 8-15 µ and 4.5-6 µ, respectively. The cytoplasm of these cells was darkly stained towards the
luminal border while the remaining part of supranuclear zone was relatively less eosinophilic. The infra nuclear zone was lightly stained or unstained. The darkly stained nuclei were mostly elongated or oval in shape and measured 4 to 6 μ in height with a width of 2 to 4 μ. Their nuclear chromatin was adhering to nuclear envelope and the acidophilic nucleolus was placed centrally. The nuclei showed moderate to intense Feulgen reaction. The cell boundaries were distinct with intense eosinophilic basement membrane. At 78th day of gestation, nuclei of few of the cells were close to luminal border. At 84th day of gestation, the duct was lined by simple columnar epithelium. On 88th day of gestation, the epithelium showed slight tendency of pseudostratification. Triangular basal cells with vesicular nuclei were fewer in number. Cytoplasm of epithelial cells showed mild reaction for PAS, alkaline and acid phosphatase. The luminal border exhibited intense reaction for PAS, acid mucopolysaccharides, alkaline and acid phosphatase. The columnar cells had lipid granules.

In III group, the duct was lined by tall columnar to pseudostratified columnar epithelium. At 98th day of gestation, few narrow columnar cells were also observed (Fig. 3). At 108th day of gestation, the cells were pyramidal to columnar shaped. The degenerated mass present in the lumen was eosinophilic in character. The rest of features were almost similar as described earlier.

In IV group, the mucosa was lined by pseudostratified columnar epithelium. There was gradual increase in number of longitudinal folds. Columnar cells at 125th day onwards became very tall. The supra nuclear zone had slightly foamy cytoplasm towards the luminal border and infra nuclear zone was almost vacuolated. The cytoplasm of columnar cells presented slightly variable histochemical reactions than in other groups.

Lamina propria and tunica muscularis could not be separated upto 77th day of gestation. One to two layers of spindle shape cells, whose nuclei were darkly stained were present close to basement membrane (Fig. 2). Fine reticular fibres were present on 66th day of gestation. Branching and anatomizing pattern of reticular fibres was observed on 78th day of gestation. The layer of fibroblasts was followed by closely packed mass of spherical, oval and fusiform mesenchymal cells. The cytoplasm of these cells was slightly eosinophilic whereas, nuclei were spherical, ovoid or spindle in shape. The nuclear chromatin was evenly distributed towards periphery.

At 78th day, the lamina propria and tunica muscularis were somewhat distinguishable from each other. The area of tunica muscularis lying close to lamina propria was lightly stained and outer area was darkly stained at this stage. Tunica muscularis was compactly arranged in outer layer and and contained circularly arranged differentiating non-striated myocytes with spindle shaped nuclei. At 84th day, few of the spindle shaped cells became elongated, the fore runners of smooth muscle cells. The average thickness of tunica muscularis in this group was 54.00 μ. The lamina propria and tunica muscularis showed mild reaction for PAS, alkaline phosphatase, mild to moderate reaction for acid mucopolysaccharides and acid phosphatase.

In III group, distinct lamina propria and tunica muscularis were present at 106th day. The inner lighter and outer darker eosinophilic zones of tunica muscularis were observed as reported in a day old buffalo calf (Chandra Pal, 1976). The muscle cells were arranged as inner circular, middle oblique as well as circular, and outer circular and few longitudinally oriented muscle fibres. In between muscle bundles, fine collagen and reticular fibres along with small blood vessels were noticed along with connective tissues cells. The mean thickness of tunica muscularis was 70.3 μ. The lamina propria exhibited histochemical reactions for different moieties as described earlier. In IV group, at 125th day onwards there was an increase in thickness of lamina propria and tunica muscularis layer. The average thickness of tunica muscularis was 133 μ. The outer zone of muscles formed the bundles whereas inner zone was loosely arranged as described in a day old buffalo calf (Chandra Pal, 1976).

Tunica serosa not separable from tunica muscularis in I and II groups was separable in III and V groups. It contained numerous blood vessels, nerves and loosely arranged connective tissue fibres. Endothelium of blood vessels showed intense reaction for PAS. It also contained collagen and few irregular reticular fibres below the mesothelium. Dellmann (1971) stated that the outer most layer of the vas deferens was serosa.

**Ampulla of vas deferens:** At 84th day of gestation, macroscopically the wall of the vas deferens showed dilation, referred as ampulla of vas deferens. The mucosa contained 30-36 μ pseudostratified columnar epithelium with distinct cell boundaries. Epithelial cells were tall columnar or pyramidal in shape and measured 20-27 μ in height and 4-6 μ in width. The cytoplasm was vacuolated in infra nuclear zone while the supranucelar zone contained...
eosinophilic cytoplasm. The nuclei were mostly elongated or ovoid in shape and measured 7 to 9 μm in height and 3-4 μm in width.

In III group, at 98th day of gestation, the luminal border was more eosinophilic in nature and nucleolus was indistinct. Few of the basal cells were triangular or pyramidal in shape situated close to the basement membrane. The foamy cytoplasm was lightly eosinophilic in nature. In IV group, the mucosa contained longitudinal folds. The size of the cells increased. The basal cells were more in number and their boundaries were distinct.

At 135th day, the mucosa was dipped down into underlying mesenchymal tissue forming the primordia of ampullary glands. The basement membrane and luminal border of ampulla showed intense PAS reaction in all groups.

In II group, the lamina propria and submucosa could not be separable. In III group, the fibroblasts appeared spindle shaped. The fibroblasts nuclei were more darkly stained than the other mesenchymal cells. In subsequent days, the lamina propria submucosa of this group was continuous with each other. Submucosa contained mesenchymal cells, fibroblasts, irregularly arranged reticular and collagenous fibres. The submucosa was thicker than muscular layer. The cytoplasm of the mesenchymal cells showed moderate reaction for PAS and acid mucopolysaccharides (Fig. 4). In IV group, at 135th day, the lamina propria contained 2-3 layers of differentiating fibroblasts with abundant reticular fibres. These cells were more compactly arranged. The submucosa contained ampullary glands, which were mostly solid and revealed intense PAS reaction.

At 98th day of gestation, the tunica muscularis contained 2-3 layers of spindle shaped mesenchymal cells having lightly stained nuclei which began to arrange themselves in circular manner. The thickness of tunica muscularis layer increased at 135th and 144th day and contained 5-6 layers of circularly arranged cells with some oblique fibres. It appeared more eosinophilic than the submucosal layer and showed intense reaction for acid mucopolysaccharides and mild to moderate for PAS.

Tunica adventitia contained very thin layer of loose connective tissue fibres with blood vessels. At 144th day, it contained mainly reticular and collagen fibres. The connective tissue showed histochemical reactions similar to tunica serosa.

REFERENCES


