

Introduction

The vas deferens, also known as the *ductus deferens* or *spermatic duct*, is a tubular conduit that begins at the tail of the epididymis and ends by joining the excretory duct of the seminal vesicle to form the ejaculatory duct. During the in situ inspection of a perinatal autopsy prior to testicular descent, the vas deferens is grossly recognized as a thin structure traveling from the tail of the epididymis over the ipsilateral umbilical artery toward the midline and terminating posterior to the urinary bladder at the base of the prostate. After testicular descent, the vas deferens can be seen emanating from the internal inguinal ring and terminating again at the prostatic base.

The histology of the vas deferens in the fetus and neonate is not well studied, but some significant changes, especially in the structure of the muscular wall, are known to occur over the fetal period. This chapter reviews the development and histological changes in the vas deferens during gestation.

Embryology

The vas deferens is derived from the mesonephric duct. As reviewed in the Part IV introduction, at approximately the seventh gestational week, two curves divide the mesonephric duct into three segments. The two most caudal segments, distal to the tail of the epididymis, become the vas deferens and terminate in the urogenital sinus.

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Histology

The fetal vas deferens is a tubular structure with an epithelium-lined lumen and a mesenchymal or muscular coat. In the adult vas deferens, a thin layer of connective tissue containing elastic fibers is seen beneath the epithelium, but these fibers are lacking in infants and children [1]. On hematoxylin and eosin (H&E)-stained sections of the fetal vas deferens, the epithelium appears to be in close contact with the muscular coat, with little to no intervening connective tissue.

In the early midtrimester, the vas deferens is thin, with a round to ovoid lumen (Figs. 12.1 and 12.2). The epithelium is well developed and appears as a columnar to pseudostratified columnar epithelium. The apical border of the lining cells displays a prominent eosinophilic terminal bar, a marker of the stereocilia present on the surface of these cells. Unfortunately, the stereocilia may appear sloughed or are not

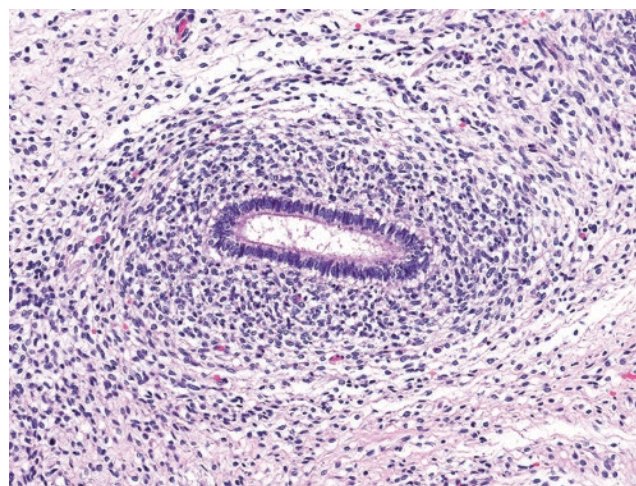


Fig. 12.1 Vas deferens at 17 weeks gestation. Early in the midtrimester, the vas deferens is characterized by a central lumen surrounded by mesenchyme, with very little hint of smooth muscle differentiation. The lining of the vas deferens consists of a columnar epithelium with a well-defined terminal bar and cilia on the apical surface (H&E, 20×)

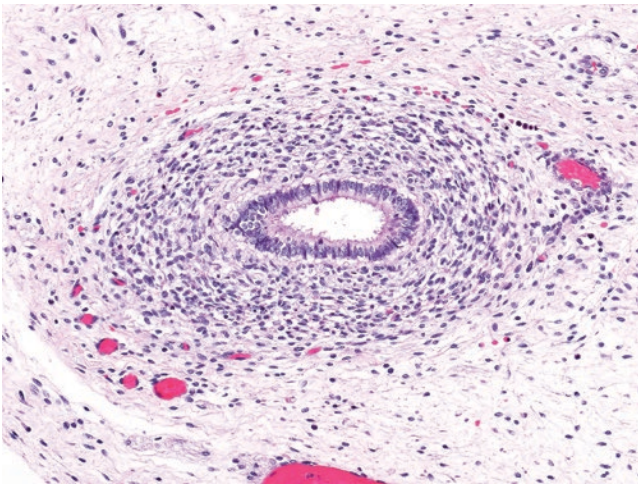


Fig. 12.2 Vas deferens at 20 weeks gestation. The epithelial lining has not changed significantly, but the surrounding mesenchyme is slightly more organized, with increased cytoplasm noted in the spindle-shaped cells (H&E, 20 \times)

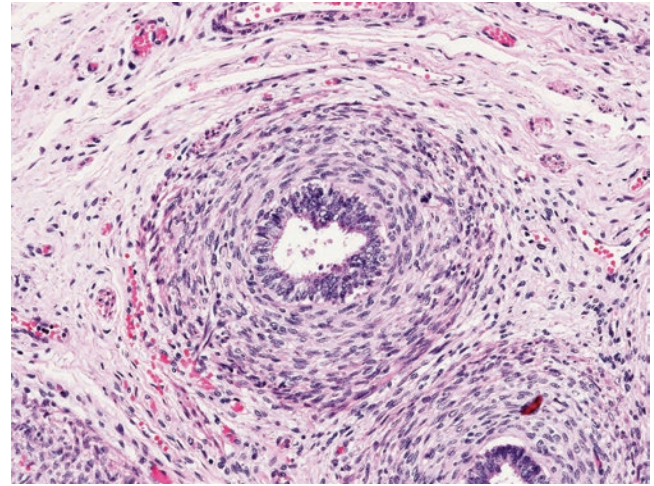


Fig. 12.3 Vas deferens at 24 weeks gestation. By the late midtrimester, the wall of the vas deferens appears more organized and shows clear smooth muscle differentiation. The epithelium appears as pseudostratified columnar epithelium with cilia (H&E, 20 \times)

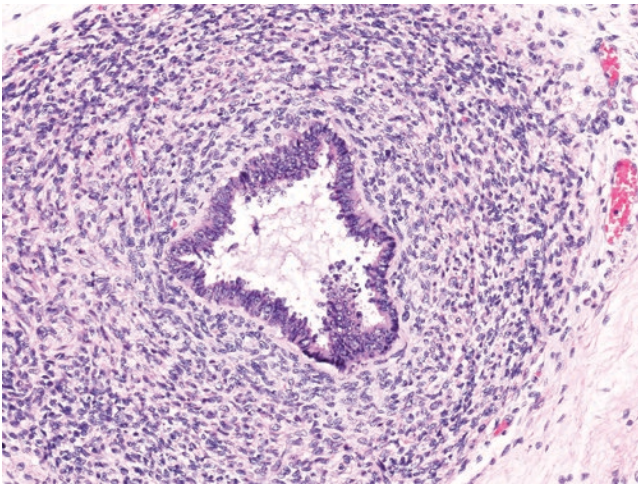


Fig. 12.4 Vas deferens at 29 weeks gestation. This section is from the ampullary region of the vas deferens; the lumen is slightly larger and irregular. The epithelium is pseudostratified columnar, and cilia are not well preserved. The muscular coat is thick, and smooth muscle differentiation can be seen (H&E, 20 \times)

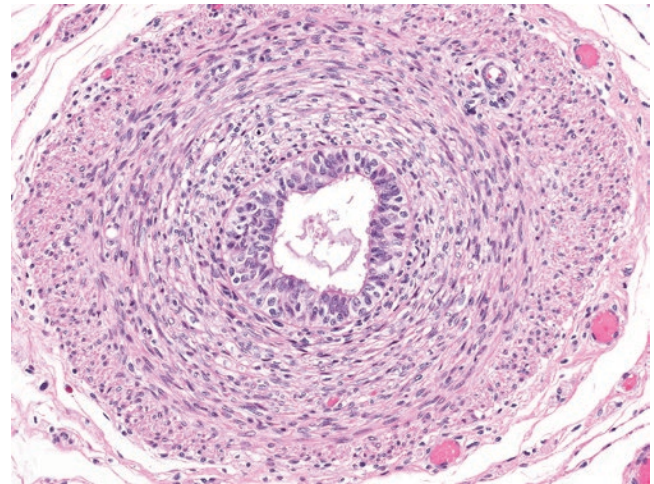


Fig. 12.5 Vas deferens at 34 weeks gestation. At this gestational age, the wall of the vas deferens exhibits well-developed smooth muscle, and the beginning of layers can be identified. The epithelium is pseudostratified columnar, with cilia noted on the apical surface. Basal cells can be seen along the basement membrane (H&E, 20 \times)

easily seen in sections from autopsy material, as preservation is typically suboptimal. The muscular coat of the vas deferens in this early stage of gestation is present; it appears as concentric layers of closely packed, spindle-shaped mesenchymal cells without significant smooth muscle differentiation (see Figs. 12.1 and 12.2).

As gestation progresses into the late midtrimester to the early third trimester, the muscular coat develops further and thickens (Figs. 12.3 and 12.4). The vas deferens widens in diameter. The epithelium remains unchanged, but the mesenchyme of the muscle wall begins to take on a more eosinophilic appearance as smooth muscle differentiation progresses.

Near term, the muscular wall of the vas deferens becomes quite thick, and spindle-shaped cells show definitive smooth muscle differentiation. The formation of distinct layers of muscle also becomes apparent (Figs. 12.5 and 12.6), although some research has stated that evidence of separate layers of muscle is not apparent until after birth [2]. In the mature, adult vas deferens, there are inner and outer longitudinal muscle layers and a middle oblique or circular layer [1]. The appearance of the lining epithelium of the vas deferens remains constant throughout gestation as a columnar to pseudostratified columnar epithelium with

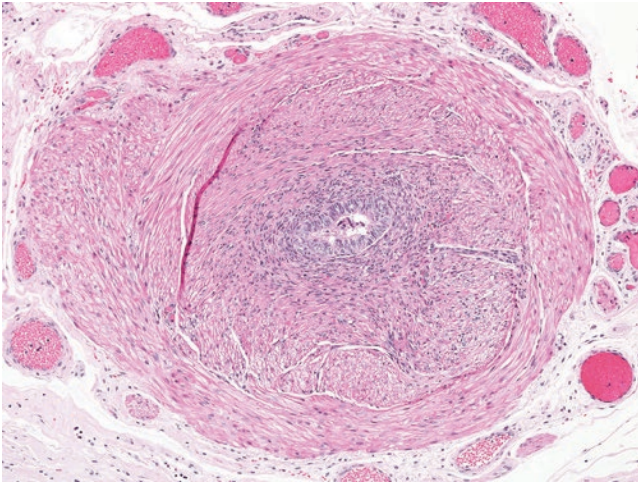


Fig. 12.6 Vas deferens at 38 weeks gestation. This low-power image shows that the vas deferens is larger at term. Note the well-defined smooth musculature of the wall, now divided into distinct layers (H&E, 10 \times)

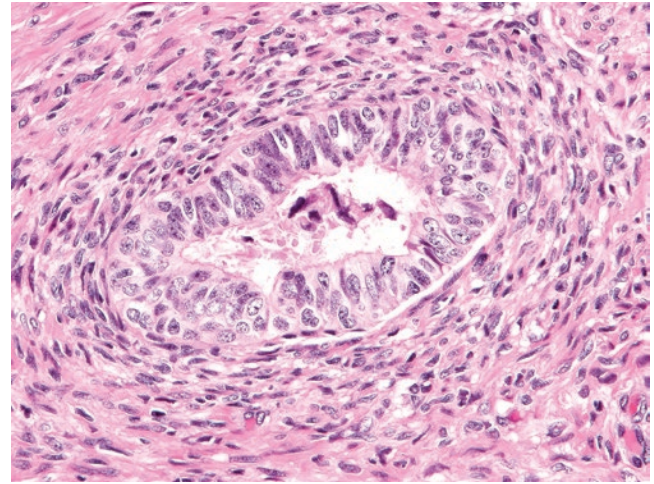


Fig. 12.7 Vas deferens at 38 weeks gestation. This higher-power image shows the luminal lining characterized by a pseudostratified columnar epithelium with poorly preserved cilia (H&E, 40 \times)

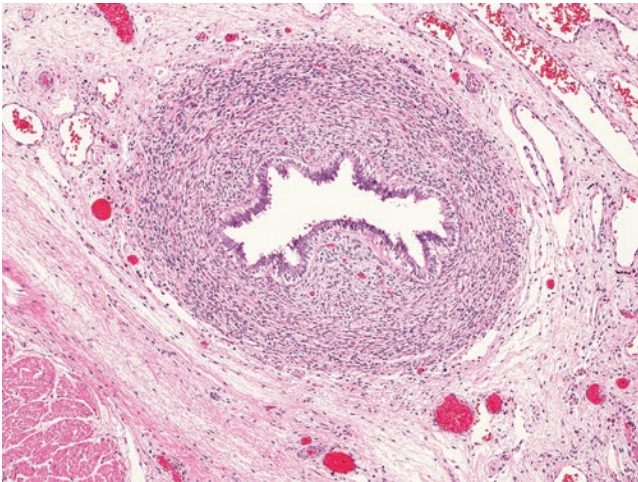


Fig. 12.8 Ampulla of the vas deferens at 34 weeks gestation. This low-power image shows the larger, wider lumen of the vas deferens in the ampullary region. Note the outpouchings of the lumen characteristic of the ampulla (H&E, 10 \times)

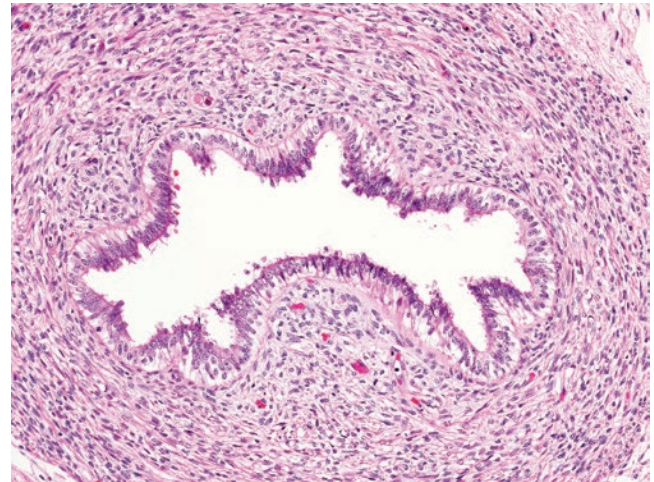


Fig. 12.9 Ampulla of the vas deferens at 34 weeks gestation. This higher-power image shows the widened and more complex ampullary lumen. Note that the epithelium is not distinctly different from the more proximal vas deferens. Basal cells and stereocilia can be appreciated (H&E, 20 \times)

stereocilia (Fig. 12.7). A layer of basal cells is described to be present in the mature vas deferens [1], but they are difficult to appreciate in routine fetal sections. Ultrastructural studies have identified at least four different cell types within the epithelium of the mature vas deferens: principal cells, pencil or peg cells, mitochondria-enriched cells, and basal cells [1].

The proximal portion of the vas deferens has a round to ovoid lumen (see Figs. 12.1, 12.2, and 12.3), but distally, in the area anatomically known as the ampulla, the lumen of the vas deferens widens. In sections of the distal vas deferens, this wider lumen can be appreciated with small

outpouchings of the lumen, imparting a somewhat stellate appearance to its shape (see Figs. 12.4, 12.8, and 12.9).

References

1. Trainer T. Testis and excretory duct system. In: Mills SE, editor. *Histology for pathologists*. 4th ed. Philadelphia: Lippincott Williams & Wilkins; 2012. p. 1003–26.
2. Dixon JS, Jen PY, Gosling JA. Structure and autonomic innervation of the human vas deferens: a review. *Microsc Res Tech*. 1998;42:423–32.