II.1.1 Anatomy and Histology of the Male Genital Tract

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II.1.1 Testis and Scrotum

II.1.1.1 Testis

The testis has two major functions: the production of the male gamete, the spermatozoa, in a process called spermatogenesis and the synthesis and controlled release of testosterone as the main androgen, termed steroidogenesis. The testes are paired oval-shaped organs suspended outside the abdominal pelvic cavity resulting in a temperature 2–3°C below the core body temperature of 37°C. Sperm development will only progress normally at this cooler temperature. The venous plexus pampiniformis also contributes to the cooling since it is found to coil around the testicular artery to absorb heat from the arterial blood thus cooling it before it enters the gonad. Before birth the testes descend from the abdominal cavity where they develop through the inguinal canal into the scrotum. During their course they become invested by coverings derived from the serous, muscular and fibrous layers of the abdominal parietes as well as by the scrotum. Each testis is surrounded by a whitish tough fibrous capsule, the tunica albuginea, which contains smooth muscle cells. At the dorsal surface the tunica albuginea thickens and forms the testicular mediastinum. Here, blood and lymphatic vessels, nerves and the efferent ducts draining spermatozoa to the epididymis enter or leave the gonads. From the tunica albuginea approximately 250 fibrous trabeculae are given off centripetally subdividing the testicular parenchyma into lobules. In each lobule one to four highly convoluted seminiferous tubules are found, which produce sperm (Fig. II.1.1). The seminiferous tubules are continuous at both ends with other tubules, the ductuli efferentes, which transport the sperm from the testis to the ductus epididymidis.

II.1.1.2 Interstitial Compartment

The production of androgens and spermatozoa occurs in two discrete compartments within the testis. Spermatozoa develop within the seminiferous tubules in close association with the Sertoli cells, whereas the androgens are produced in the Leydig cells located in the interstitial space between the tubules (Fig. II.1.1). Besides the Leydig cells the interstitial space mainly comprises fibrocytes, blood and lymphatic vessels and a significant number of leukocytes (mainly macrophages and to a lesser extent T lymphocytes and mast cells). The Leydig cells often aggregate in small clusters around blood vessels and are rich in smooth endoplasmic reticulum, a characteristic structural feature of steroid-hormone-synthesizing cells. They have abundant pink cytoplasm with lipid, lipochrome pigment, Reinke crystalloids (hexagonal prisms by electron microscopy) as well as round nuclei with distinct nucleoli and are often associated with nerve fibres. Scattered Leydig cells are also found in the spermatic cord (funiculus spermaticus) as well as in the tunica albuginea. Leydig cells synthesize testosterone as the main androgen and many proteinergic factors such as growth factors, neuropeptides and cytokines. Normal Leydig cell function is dependent on luteinizing hormone (LH).

II.1.1.3 Scrotum

The scrotum is a cutaneous pouch that encloses the testes and the lower part of the spermatic cords. A raphe is visible on the median surface of the scrotum, which extends forward under the surface of the penis and backward as a tangible ridge along the middle line of the perineum to the anus. The external appearance of the scrotum varies under different circumstances from short and corrugated to elongated and flaccid. The scrotum consists of the following layers from outside to inside:
II.1 Understanding Normal Anatomy and Function

II.1.1 Physiology

II.1.1.4 Vessels and Nerves

The artery supplying the testis and epididymis is the testicular artery which originates directly from the abdominal aorta underneath the renal artery. The testicular vein fans out to the plexus pampiniformis which follows the course of the testicular artery. Both vessels are found within the spermatic cord. After passage through the inguinal canal the veins reunite and drain on the left into the renal vein and on the right side into the inferior vena cava. The scrotum and its coverings receive their arterial blood supply via the cremasteric artery from the inferior epigastric and branches of the pudendal artery. The veins follow the corresponding arteries. The lymphatics of the testis end in paraaortic lymph nodes around the origin of the testicular artery (nodi lymphatici lumbales), whereas the scrotal lymphatics lead to the inguinal lymph nodes. The cremasteric muscle, the tunica dartos and the scrotal skin are innervated by the scrotal rami of the ilioinguinal nerve and by branches of the pudendal nerve.

II.1.2 Epididymis

The epididymis consists of a central body (corpus epididymidis), an upper enlarged extremity (caput epididymidis), and a lower pointed part, the tail (cauda epididymidis), which is continuous with the ductus deferens. The epididymis is covered by a thin fibrous tunica albuginea and is connected to the back of the testis by two small ligaments. The head of the epididymis is palpable through the skin of the scrotum and therefore accessible for clinical inspection. The rete testis at the dorsocranial part of the testis connects the seminiferous tubules with the efferent ducts in the caput of the epididymis. Approximately 6–12 efferent ducts converge into a single duct, the epididymal duct, which is highly convoluted and increases in diameter and thickness as it meanders to the ductus deferens. The convolutes are held together by fine connective tissue. The head of the epididymis contains the efferent ducts and the proximal end of the epididymal duct, whereas corpus and cauda include only the epididymal duct. Histologically the epithelium of the terminal part of the seminiferous tubules contains only Sertoli cells, and it gradually blends with the cuboidal or columnar epithelium of the rete testis. These epithelial cells may actually represent a continuation of the Sertoli cells that line the seminiferous tubules. The efferent ducts are characterized by a columnar epithelium of different height which gives the inner surface a wave-like appearance.