External Genitalia-Male

Penis

The penile urethra serves as a common channel for conducting urine and seminal fluid to the exterior. It is contained within a cylinder of erectile tissue, the corpus cavernosum urethrae (corpus spongiosum) that lies ventral to a pair of similar erectile bodies called the corpora cavernosa penis. Together the three structures make up the bulk of the penis, the copulatory organ of the male. The corpora cavernosa penis begins as separate bodies along the rami of the pubis on either side and joins at the pubic angle to form the shaft of the penis. They are united by a common connective tissue septum called the pectiniform septum, and each corpus is surrounded by a thick, primarily collagenous sheath, and the tunica albuginea. Trabeculae of collagenous and elastic fibers with numerous smooth muscle cells extend into the corpora from the tunica albuginea and divide the central regions of the corpora cavernosa into numerous cavernous spaces, those near the center being the larger. These spaces are endothelial-lined vascular spaces and are continuous with the arteries that supply them and with draining veins. The cavernous tissue of each corpus cavernosum penis communicates with the other through numerous slitlike openings in the pectiniform septum. The ventrally placed corpus cavernosum urethrae (corpus spongiosum) ends in an enlargement, the glans penis, which forms a cap over the ends of the corpora cavernosa penis. Structurally, corpus spongiosum is similar to the corpora cavernosa penis, but the tunica albuginea is thinner and contains more elastic fibers and smooth muscle cells, and the trabeculae are thinner and contain more elastic tissue. The three corpora are bound together by subcutaneous connective tissue that contains numerous smooth muscle cells but is devoid of fat. A thin, mobile skin that shows a slight increase in pigmentation covers the shaft of the penis. The skin of the distal shaft, unlike that of the root, lacks hair but does contain scattered sweat glands. The hairless skin of the glans penis is fused to the underlying connective tissue and is nonmobile. Unusual sebaceous glands not associated with hair follicles occur in this region. A fold of skin called the prepuce or foreskin, the inner surface of which is moist and resembles a mucous membrane, covers the glans penis. Numerous free nerve endings are present in the epithelium of the glans penis, prepuce, and subepithelial connective tissue of the urethra and skin. Meissner's corpuscles are associated with the epidermis of the genitals, and Vater-Pacini corpuscles are present in the deeper layers of the dermis.

Arterial Supply

The principal arterial supply to the penis is from two arteries that lie dorsal to the corpora cavernosa penis and deep arteries that run within the erectile tissue of these structures. Branches from the dorsal arteries penetrate the tunica albuginea and enter the cavernous tissue, where the arteries branch and either form capillary plexuses or course distally in the cavernous tissue. These helicine arteries are highly convoluted in the flaccid penis and take a spiral course through the trabeculae of the cavernous tissue. The intima of most of these arteries, even before they enter the cavernous tissue, have long, ridgelike thickenings that project into and partially occlude the lumina. These intimal ridges are most frequent where vessels branch. They consist of loose connective tissue that contains many smooth muscle cells. Blood from the large central lacunae drains peripherally toward the smaller vascular spaces and finally into a plexus of veins at the periphery. The veins run along the interior of the tunica albuginea, pierce the limiting tunica, and drain into the deep dorsal vein of the penis.

The arterial blood supply to the corpus spongiosum is similar to that of the corpora cavernosa penis, except for the venous drainage. Beginning at the lacunae, the veins of the corpus spongiosum have large openings and immediately penetrate the tunica albuginea to drain to the exterior. The structure and arrangement of the blood vessels in the cavernous tissues provide the mechanism for erection. During erotic stimulation, the smooth muscle of the arterial and trabecular walls relaxes, and blood pressure overcomes the elastic resistance of the arteries. The helicine arteries dilate and straighten, and the vascular spaces of the cavernous tissues quickly fill with blood. The lacunae, especially near the center of the cavernous bodies, become engorged with blood, thus compressing the small peripheral spaces and veins against the non-yielding tunica albuginea, retarding the egress of blood; the erectile tissues of corpora cavernosa penis become enlarged and rigid. During erection the intracavernous blood pressure may reach 1100 and 1200 mmHg in some individuals, which is about 10 times normal blood pressure. Corpus spongiosum does not become as rigid as the corpora cavernosa penis because there is less compression of the venous drainage and the tunica albuginea is thinner and more yielding. The lesser rigidity of corpus spongiosum allows the urethra to remain patent, which is essential for the passage of semen during ejaculation. After cessation of sexual activity, the smooth muscle in the arteries and cavernous tissue regains its tone. The intimal ridges once again partially occlude the lumina of the arteries, thus reducing the volume of incoming blood. Excess blood in the vascular spaces of the erectile tissue is forced out by contraction of smooth muscle cells in the trabeculae and by recoil of surrounding elastic tissue. Gradually, the normal route of blood flow through the penis is restored, and the penis returns to the flaccid condition. Sexual reflexes of men can be triggered by a variety of stimuli and involve intricate coordination of both somatic and autonomic nerve pathways. During arousal, tactile (cutaneous) stimuli are transmitted to the sacral region (S2-S4) of the spinal cord by afferent somatic fibers within the dorsal penile nerve, a branch of the pudendal nerve. Impulses of efferent parasympathetic fibers via the pelvic splanchnic nerves result in vasodilatation of arteries supplying the erectile tissues causing an erection. Efferent sympathetic fibers stimulate smooth muscle contraction within the following portions of the male reproductive system: epididymis, ductus deferens, prostate, and seminal vesicles. These contractions are coordinated with rhythmic contractions of skeletal muscle (primarily the bulbospongiosus) associated with the exterior of the penis that forcefully expel the ejaculate from the penile urethrae at emission. The muscle cells of these skeletal muscles are innervated by efferent somatic fibers of the pudendal nerve.

Scrotum

The scrotum is a pendulous, cutaneous pouch situated at the base of the penis and below the symphysis pubis. It is divided into two compartments, each of which houses a testis, an epididymis, and the lower part of the spermatic cord. The scrotum consists only of skin and a closely associated tunica dartos. The scrotal skin is thin, pigmented, and commonly thrown into folds. It contains many sweat glands, sebaceous glands that produce an odorous secretion, and some coarse hairs, the follicles of which are visible through the thin skin. The tunica dartos underlies the skin and forms the septum that divides the scrotum into its two compartments. It is firmly attached to the skin and consists largely of smooth muscle cells and collagenous connective tissue. The appearance of the scrotum varies with the state of contraction of the smooth muscle. Under influence of cold, exercise, or sexual stimulation, the muscle contracts and the scrotum becomes short and wrinkled. The spermatic cord consists of several thin layers of connective tissue that are acquired from the anterior abdominal wall as

the testes descend from the abdominal cavity into the scrotal sac during development. It contains the ductus deferens, nerve fibers, lymphatic channels, testicular artery, and a pampiniform plexus of testicular veins. As the testicular artery nears the testis, it becomes highly convoluted and is surrounded by the venous plexus. The proximity of the surrounding, cooler venous blood causes the arterial blood to lose heat and provides a thermoregulatory (counter-current heat exchange) mechanism for precooling incoming arterial blood. In this way the temperature of the testes is maintained a few degrees (2-3ºC) below body temperature, a condition necessary for production of sperm. The temperature can be elevated by drawing the testes closer to the abdominal wall by contraction of the layer of striated muscle (cremaster muscle) that invests the spermatic cord. In humans, failure of the testes to descend (cryptorchidism) results in sterility.