



The Reproductive System



22

The Male Genital
Organs, the Penis, and
the Scrotum



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THE SCROTUM

Lymph Drainage of the Scrotum

It is important to remember that the lymph drainage of the scrotal wall, including the fascia and tunica vaginalis, is into the superficial inguinal nodes. The lymph drainage of the testis and epididymis (which develop on the posterior abdominal wall) is into the lumbar or paraaortic nodes at the level of the first lumbar vertebra.

Hydrocele

This is an accumulation of fluid within the tunica vaginalis. Most hydroceles are idiopathic, but some may be caused by spread of infection from the testis or epididymis. Tapping a hydrocele is described on CD page 314.



THE TESTIS AND THE EPIDIDYMIS

Varicocele

A varicocele is a condition in which the veins of the pampiniform plexus are elongated and dilated. It is a common disorder in adolescents and young adults, with most occurring on the left side. This is thought to be because the right testicular vein joins the low-pressure inferior vena cava, whereas the left vein joins the left renal vein, in which the venous pressure is higher. Rarely, malignant disease of the left kidney extends along the renal vein and blocks the exit of the testicular vein. A rapidly developing left-sided varicocele should therefore always lead one to examine the left kidney.

Malignant Tumor of the Testis

A malignant tumor of the testis spreads upward via the lymph vessels to the lumbar (paraaortic) lymph nodes at the level of the first lumbar vertebra. It is only later, when the tumor spreads locally to involve the tissues and skin of the scrotum, that the superficial inguinal lymph nodes are involved.

Torsion of the Testis

Torsion of the testes is a rotation of the testis around the spermatic cord within the scrotum. It is often associated with an excessively large tunica vaginalis. Torsion commonly occurs in active young men and children and is accompanied by severe pain. If not treated quickly, the testicular artery may be occluded, followed by necrosis of the testis.



CONGENITAL ANOMALIES OF THE TESTIS

The testis may be subject to the following congenital anomalies:

- **Anterior inversion**, in which the epididymis lies anteriorly and the testis and the tunica vaginalis lie posteriorly
- **Polar inversion**, in which the testis and epididymis are completely inverted

■ Imperfect descent (cryptorchidism):

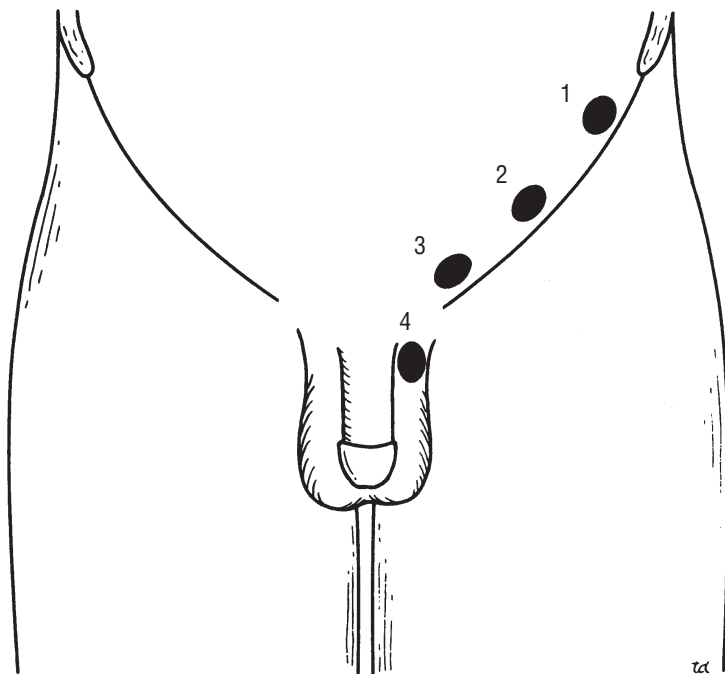
Incomplete descent (CD Fig. 22-1), in which the testis, although traveling down its normal path, fails to reach the floor of the scrotum. It may be found within the abdomen, within the inguinal canal, at the superficial inguinal ring, or high up in the scrotum.

Maldescent (CD Fig. 22-2), in which the testis travels down an abnormal path and fails to reach the scrotum. It may be found in the superficial fascia of the anterior abdominal wall above the inguinal ligament, in front of the pubis, in the perineum, or in the thigh.

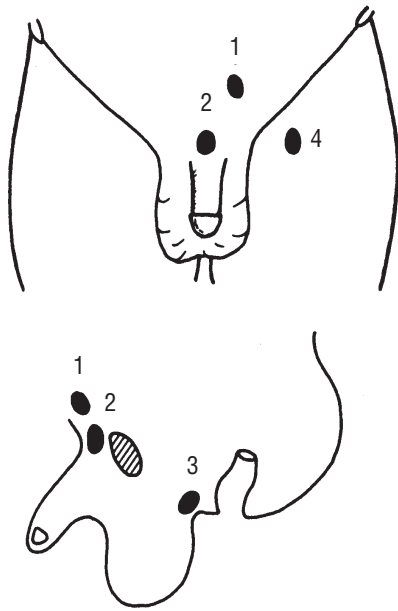
It is necessary for the testes to leave the abdominal cavity because the temperature there retards the normal process of spermatogenesis. If an incompletely descended testis is brought down into the scrotum by surgery before puberty, it will develop and function normally. A maldescended testis, although often developing normally, is susceptible to traumatic injury and, for this reason, should be placed in the scrotum. Many authorities believe that the incidence of tumor formation is greater in testes that have not descended into the scrotum.

Appendix of the Testis and Appendix of the Epididymis

These are embryologic remnants found at the upper poles of these organs that may become cystic. The appendix of the testis is derived from the paramesonephric ducts, and the appendix of the epididymis is a remnant of the mesonephric tubules.



CD Figure 22-1 Four degrees of incomplete descent of the testis. **1.** In the abdominal cavity close to the deep inguinal ring. **2.** In the inguinal canal. **3.** At the superficial inguinal ring. **4.** In the upper part of scrotum.



CD Figure 22-2 Four types of maldescent of the testis. **1.** In the superficial fascia of the anterior abdominal wall, above the superficial inguinal ring. **2.** At the root of the penis. **3.** In the perineum. **4.** In the thigh.



THE VAS DEFERENS

Vasectomy

Bilateral vasectomy is a simple operation performed to produce infertility. Under local anesthesia, a small incision is made in the upper part of the scrotal wall, and the vas deferens is divided between ligatures. Spermatozoa may be present in the first few postoperative ejaculations, but that is simply an emptying process. Now only the secretions of the seminal vesicles and prostate constitute the seminal fluid, which can be ejaculated as before.



THE PROSTATE

Prostate Examination

The prostate can be examined clinically by palpation by performing a rectal examination (see CD Chapter 19). The examiner's gloved finger can feel the posterior surface of the prostate through the anterior rectal wall.

Prostate Activity and Disease

It is now generally believed that the normal glandular activity of the prostate is controlled by the androgens and

estrogens circulating in the bloodstream. The secretions of the prostate are poured into the urethra during ejaculation and are added to the seminal fluid. Acid phosphatase is an important enzyme present in the secretion in large amounts. When the glandular cells producing this enzyme cannot discharge their secretion into the ducts, as in carcinoma of the prostate, the serum acid phosphatase level of the blood rises.

It has been shown that trace amounts of proteins produced specifically by prostatic epithelial cells are found in peripheral blood. In certain prostatic diseases, notably cancer of the prostate, this protein appears in the blood in increased amounts. The specific protein level can be measured by a simple laboratory test called the **PSA** (prostatic-specific antigen) test.

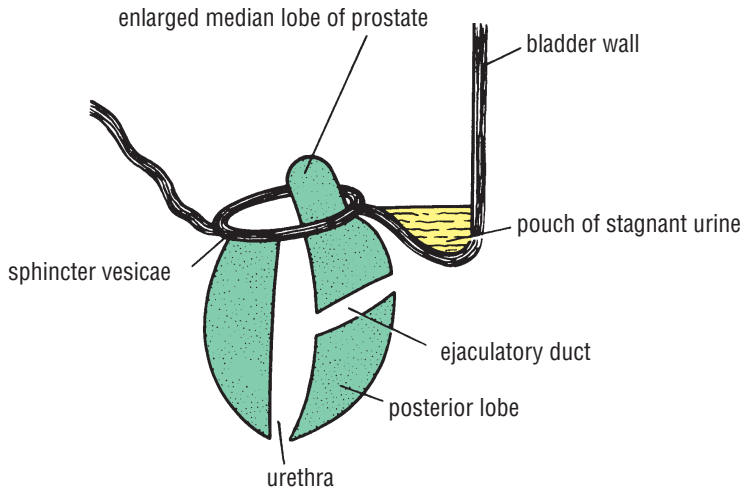
Benign Enlargement of the Prostate

Benign enlargement of the prostate is common in men older than 50 years. The cause is possibly an imbalance in the hormonal control of the gland. The median lobe of the gland enlarges upward and encroaches within the sphincter vesicae, located at the neck of the bladder. The leakage of urine into the prostatic urethra causes an intense reflex desire to micturate. The enlargement of the median and lateral lobes of the gland produces elongation and lateral compression and distortion of the urethra so that the patient experiences difficulty in passing urine and the stream is weak. Backpressure effects on the ureters and both kidneys are a common complication. The enlargement of the uvula vesicae (owing to the enlarged median lobe) results in the formation of a pouch of stagnant urine behind the urethral orifice within the bladder (CD Fig. 22-3). The stagnant urine frequently becomes infected, and the inflamed bladder (**cystitis**) adds to the patient's symptoms.

In all operations on the prostate, the surgeon regards the prostatic venous plexus with respect. The veins have thin walls, are valveless, and are drained by several large trunks directly into the internal iliac veins. Damage to these veins can result in a severe hemorrhage.

Prostate Cancer and the Prostatic Venous Plexus

Many connections between the prostatic venous plexus and the vertebral veins exist. During coughing and sneezing or abdominal straining, it is possible for prostatic venous blood to flow in a reverse direction and enter the vertebral veins. This explains the frequent occurrence of skeletal metastases in the lower vertebral column and pelvic bones of patients with carcinoma of the prostate. Cancer cells enter the skull via this route by floating up the valveless prostatic and vertebral veins.



CD Figure 22-3 Sagittal section of a prostate that had undergone benign enlargement of the median lobe. Note the bladder pouch filled with stagnant urine behind the prostate.



THE BULBOURETHRAL GLANDS

Infection of the Bulbourethral Glands

The bulbourethral glands are the common sites for chronic venereal infection (e.g., gonorrhoea). The organisms reach the gland by ascending from the bulbous part of the urethra along the duct of the gland.



THE PENIS

Circumcision

Circumcision is the operation of removing the greater part of the prepuce, or foreskin. In many newborn males, the prepuce cannot be retracted over the glans. This can result in infection of the secretions beneath the prepuce, leading to inflammation, swelling, and fibrosis of the prepuce. Repeated inflammation leads to constriction of the orifice of the prepuce (**phimosis**) with obstruction to urination. It is now generally believed that chronic inflammation of the prepuce predisposes to carcinoma of the glans penis. For

these reasons, prophylactic circumcision is commonly practiced. For Jews, it is a religious rite.

Urethral Infection

See CD Chapter 21.

Catheterization

See CD Chapter 21.

Blunt Trauma to the Penis

This may cause penile fracture when it is in the erect state. A transverse laceration of the fibrous envelopes of the erectile tissue of the penis occurs followed by the formation of a large hematoma; the base of the penis is the common site of injury. Rupture of the penile urethra may also occur and is accompanied by a bloody urethral discharge.

Penetrating Trauma to the Penis

This may injure the skin, fascia, erectile tissue, and urethra. Amputation of the entire penis should be repaired by anastomosis using microsurgical techniques to restore continuity of the main blood vessels.

Strangulation of the Penis

Strangulation of the penis by means of a ring or ligature may cause ischemia of the entire penis. It is imperative that the constriction be removed without delay to avoid compromising the blood supply.

Phimosis

In this condition the opening in the prepuce is narrowed so that it is impossible to retract the prepuce over the glans penis. Occasionally the narrowing is so extreme that the urinary flow is obstructed. The usual cause of the condition is infection under the prepuce, causing fibrosis and subsequent contraction of the prepuce.

Erection and Ejaculation after Spinal Cord Injuries

Erection of the penis is controlled by the parasympathetic nerves that originate from the second, third, and fourth sacral segments of the spinal cord. Bilateral damage to the reticulospinal nerve tracts in the spinal cord will result in loss of erection. Later, when the effects of spinal shock have disappeared, spontaneous or reflex erection may occur if the sacral segments of the spinal cord are intact.

Ejaculation is controlled by sympathetic nerves that originate in the first and second lumbar segments of the spinal cord. As in the case of erection, severe bilateral

damage to the spinal cord results in loss of ejaculation. Later, reflex ejaculation may be possible in patients with spinal cord transections in the thoracic or cervical regions.



CONGENITAL ANOMALIES OF THE PENIS

Meatal Stenosis

See CD Chapter 21.

Hypospadias

See CD Chapter 21.

Epispadias

See CD Chapter 21.

Clinical Problem Solving Questions

Read the following case histories/questions and give the best answer for each.

A 55-year-old man was admitted to the hospital with a large hard, fixed, intraabdominal mass. On examination of the abdomen, the mass was situated on the transpyloric plane and appeared to be attached to the posterior abdominal wall. The inguinal lymph nodes were normal.

- The symptoms and signs displayed by this patient can be explained by the following statements **except** which?
 - Radiologic examination of the stomach showed nothing abnormal.
 - The right testicle was enlarged and was much harder than normal.
 - A diagnosis of malignant disease of the right testis was made.
 - The malignant tumor had metastasized to the lumbar lymph nodes lying on the transpyloric plane on the posterior abdominal wall, which is the normal lymphatic drainage of the testis.
 - In malignant disease of the testis the superficial inguinal lymph nodes only become involved if the tumor spreads to involve the scrotal skin.
 - The normal testis is tethered to the skin of the scrotum.

While bathing her 5-month-old boy, a mother noticed that his penis tended to curve downward. She decided to seek advice from a pediatrician.

- The pediatrician examined the child and made the following possible correct observations and statements **except** which?
 - The penis had a definite downward curvature (chordee).
 - Both testes were in the scrotum.
 - The external urethral meatus opened halfway along the undersurface of the penis.
 - The fusion of the genital folds on the ventral or undersurface of the shaft of the penis was incomplete so that the urethra opened on the ventral surface.
 - The condition is a rare congenital anomaly.
- The pediatrician made the following possible correct statements to the mother regarding the diagnosis and treatment **except** which?
 - The child had hypospadias associated with chordee.
 - The proximal portion of the penile urethra had developed normally but was incomplete.
 - The bud of cells (ectodermal) on the tip of the glans penis had failed to grow into the substance of the

- glans and join with the cells (entodermal cells) of the penile urethra.
- D. The treatment is the surgical correction of the chordee, which is followed by the plastic reconstruction of the penile urethra.
- E. In view of the delicate tissues involved, the treatment should be delayed until the child is at least 10 years old.
4. A 65-year-old man with a history of prostatic disease was found on radiographic examination of his skeleton to have extensive carcinomatous metastases in his skull and lumbar vertebrae. His PAS levels in his blood were very much higher than normal. Using your knowledge of anatomy, can you suggest a possible route taken by the cancer cells as they migrated from the prostate to (1) the lumbar vertebrae and (2) the skull?
 5. An 88-year-old man had a history of prostatic disease. His latest symptoms included difficulty in starting to micturate, a poor urinary stream, and difficulty in stopping the flow of urine. Which lobe or lobes of the prostate are related to the sphincter vesicae? The enlargement of which lobe is likely to interfere with the sphincter's function?
 6. A 6-year-old boy was examined by a pediatrician and found to have no testicle present in the right side of his scrotum. On careful palpation, a deep, firm ovoid structure could be felt above the medial part of the inguinal ligament. What is the diagnosis? Is surgical treatment necessary?
 7. An 18-year-old boy, at a medical examination for admission to the army, was found to have no testis in the left side of the scrotum. Nothing abnormal could be palpated in the inguinal canal, but a small, firm ovoid structure could be felt in front of the upper part of the left thigh. What is the diagnosis? Is surgical treatment required?
 8. A 25-year-old man developed a swelling above the medial end of the right inguinal ligament. It was associated with a dull, aching pain, but it did not expand on coughing. On palpation, the swelling appeared to fluctuate, and on grasping the right testis through the scrotal wall and gently pulling it inferiorly, the swelling moved medially along the inguinal canal. What was the swelling? Why did it move with the testis?
 9. A patient suffering from tuberculosis of the left epididymis was found to have an ulcer on the posterior surface of the scrotum. Which group of lymph nodes would you examine for local spread of the disease?
 10. A resident was asked to examine the vas deferens of a patient. Where would you examine the vas deferens and what does a normal vas feel like?
 11. In a patient with a history of venereal disease, a large, fluctuant swelling developed in front of the left testis. From your knowledge of anatomy, and given that there is fluid present in the scrotum, where in the scrotum is the fluid likely to collect?
 12. A 50-year-old man was found on examination to have a small cystic swelling above his right testis. What anatomic structure is likely to be involved? Can you explain the presence of this structure embryologically?
 13. A 25-year-old man was found, during a physical examination, to have an abnormal scrotum. On feeling the scrotum with the palm of the hand, it felt like a bag of worms. This situation was caused by an enlargement of the pampiniform plexus on the left side. The physician examined the scrotum and then the left kidney. Can you explain why he should examine the left kidney?

Answers and Explanations

1. **F** is the correct answer. The normal testis is freely mobile within the scrotum and is not tethered to the subcutaneous tissue or skin.
2. **E** is the correct answer. The condition is one of the most common congenital anomalies affecting the male urethra.
3. **E** is the correct answer. The surgical treatment should start at about the age of 2 years and be complete before the child goes to school. Little boys like to look the same as other little boys.
4. The prostatic venous plexus is drained into the internal iliac veins. Large valveless veins also connect the plexus to the valveless vertebral veins. On coughing or sneezing, the blood may be forced from the prostatic plexus in the pelvis into the vertebral veins. Dislodged prostatic cancer cells may be carried along this route to the vertebral column. They may also pass up the vertebral plexus to enter the veins of the skull.
5. The median (middle) lobe of the prostate is located between the prostatic urethra and the ejaculatory ducts,

just inferior to the sphincter vesicae. Benign hypertrophy of the median lobe results in its upward expansion within the sphincter vesicae. The sphincter can no longer function effectively, and urine continues to dribble into the urethra, giving the patient an intense desire to continue to micturate.

6. The boy had an incompletely descended testis on the right side. The right testis was situated in the inguinal canal. Spontaneous descent of the testis usually occurs without treatment. The injection of gonadotropic hormone can be used to speed up the descent. However, if the descent has not occurred by the age of 10 years, surgical treatment is necessary to place the testis in the scrotum. The high temperature of the abdominal cavity and inguinal canal inhibits normal spermatogenesis.
7. The boy had a maldescended testis on the left side. Instead of following the gubernaculum down into the scrotum, it passed laterally and came to rest in the superficial fascia in the upper part of the left thigh. A maldescended testis is very prone to injury and should be placed in the scrotum by surgical means.
8. The patient had a right encysted hydrocele of the spermatic cord. This is a cyst in the remnant of the upper part of the processus vaginalis and is connected to the tunica vaginalis by a fibrous strand (a further remnant of the processus). On pulling down the testis and the tunica vaginalis, the cyst was pulled medially by the fibrous strand.
9. The skin of the scrotum, the fascia, and the tunica vaginalis drain their lymph into the superficial inguinal lymph nodes.
10. Palpate the upper part of the scrotum between finger and thumb, and you can roll the vas deferens as a cord-like structure. It has a smooth external wall and is firm in consistency. Remember there are two sides and to always compare the two.
11. The tunica vaginalis covers the front and sides of the testis, and the visceral layer is in direct contact with the tunica albuginea of the testis. Infection causes an excessive production and accumulation of fluid within the tunica, a condition known as hydrocele.
12. The patient has a cyst of the appendix of the testis, a structure that is derived embryologically from the paramesonephric duct.
13. The left pampiniform plexus is drained by the left testicular vein, which is drained into the left renal vein. A malignant tumor of the left kidney could spread along the left renal vein, blocking the exit of the left testicular vein and causing congestion and varicosity of the left pampiniform plexus. This is a rare cause. The majority of varicoceles are idiopathic.