

# Genitourinary System

CHAPTER

11

## Chapter Outline

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- Operative report: Extracorporeal shock-wave lithotripsy

## Objectives

Upon completion of this chapter, you will be able to:

- Locate and describe the urinary structures as well as the structures of the male reproductive system.
- Describe the functional relationship between the genitourinary system and other body systems.
- Identify, pronounce, spell, and build words related to the genitourinary system.
- Describe pathological conditions, diagnostic and therapeutic procedures, and other terms related to the genitourinary system.
- Explain pharmacology related to the treatment of urinary disorders as well as male reproductive disorders.
- Demonstrate your knowledge of this chapter by completing the learning and medical record activities.



## Anatomy and Physiology

The male and female urinary systems have similar structures. In the male, however, some of the urinary structures also have reproductive functions. Thus, the genitourinary system includes the urinary system of both the male and female as well as the reproductive system of the male.

### Urinary System

The purpose of the urinary system is to regulate the composition of the extracellular fluids of the body by removing their harmful substances in the form of urine, while retaining beneficial products. Harmful substances, including **nitrogenous wastes** and excess **electrolytes**, are removed by the kidneys and

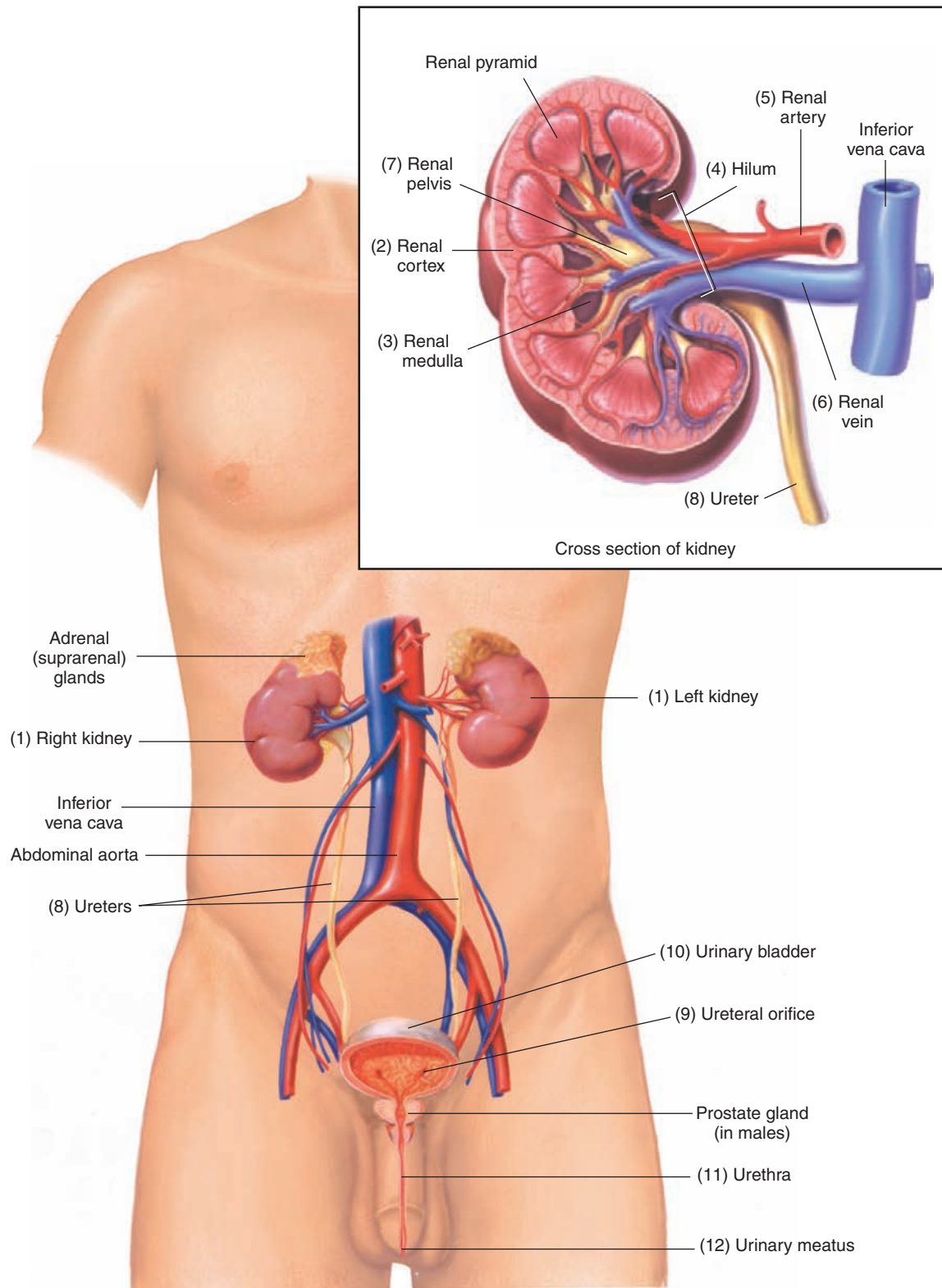
excreted from the body in urine. Nitrogenous wastes are toxic to the body, and must be continuously eliminated or death will occur. Electrolyte concentration must remain fairly constant for proper functioning of nerves, heart, and muscles. An excess or deficiency of electrolytes can have devastating effects. Besides regulating the composition of extracellular fluids, kidneys also secrete the hormone **erythropoietin**. This hormone acts on bone marrow to stimulate production of red blood cells when blood oxygen levels are low. The macroscopic structures that make up the urinary system include:

- two kidneys
- two ureters
- bladder
- urethra. (See Figure 11–1.)

### Anatomy and Physiology Key Terms

*This section introduces important genitourinary system terms along with their definitions and pronunciations. Word analyses are provided for selected terms.*

Term	Definition
<b>electrolytes</b> ē-LĚK-trō-līts	Mineral salts (sodium, potassium, and calcium) that carry an electrical charge in solution <i>A proper balance of electrolytes is essential to the normal functioning of the entire body but especially nerves, muscles, and heart.</i>
<b>filtrate</b> FĪL-trāt	Fluid that passes from the blood through the capillary walls of the glomeruli of the kidney <i>Filtrate is similar to plasma but with far less protein. Urine is formed from filtrate.</i>
<b>nitrogenous wastes</b> nī-TRŌJ-ĕn-ŭs	Products of cellular metabolism that contain nitrogen <i>Nitrogenous wastes include urea, uric acid, creatine, creatinine, and ammonia.</i>
<b>peristaltic waves</b> pĕr-ĭ-STĀL-tĭk	Sequence of rhythmic contraction of smooth muscles of a hollow organ to force material forward and prevent backflow
<b>peritoneum</b> pĕr-ĭ-tō-NĒ-ŭm	Serous membrane that lines the abdominopelvic cavity and covers most of the organs within the cavity
<b>plasma</b> PLĀZ-mă	Liquid portion of blood, composed primarily of water (90%), and containing dissolved proteins, nutrients, lipids, and various waste products
<b>semen</b> SĒ-mĕn	Fluid containing sperm and secretions from the prostate and other structures of the male reproductive system; also called <i>seminal fluid</i>
<b>testosterone</b> tĕs-TŌS-tĕr-ŏn	Androgenic hormone responsible for the development of the male sex organs, including the penis, testicles, scrotum, and prostate <i>Testosterone is also responsible for the development of secondary sex characteristics (musculature, hair patterns, thickened vocal cords, and so forth).</i>
<b>Pronunciation Help</b>	Long Sound    ā—rate    ē—rebirth    ĩ—isle    ō—over    ū—unite Short Sound    ă—alone    ě—ever    ĭ—it    ȏ—not    ŭ—cut



**Figure 11-1.** Urinary structures, including a cross section of the kidney.

The (1) **left and right kidneys**, each about the size of a fist, are located in the abdominal cavity slightly above the waistline. Because they lie outside of the **peritoneum**, their location is said to be *retroperitoneal*. A concave medial border gives the kidney its beanlike shape. In a frontal section, two distinct areas are visible: an outer section, the (2) **renal cortex**, and a middle area, the (3) **renal medulla**, which contain portions of the microscopic filtering units of the kidney called *nephrons*. Near the medial border is the (4) **hilum** (also called *hilus*), an opening through which the (5) **renal artery** enters and the (6) **renal vein** exits the kidney. The renal artery carries blood that contains waste products to the nephrons for filtering. After waste products are removed, blood leaves the kidney by way of the renal vein.

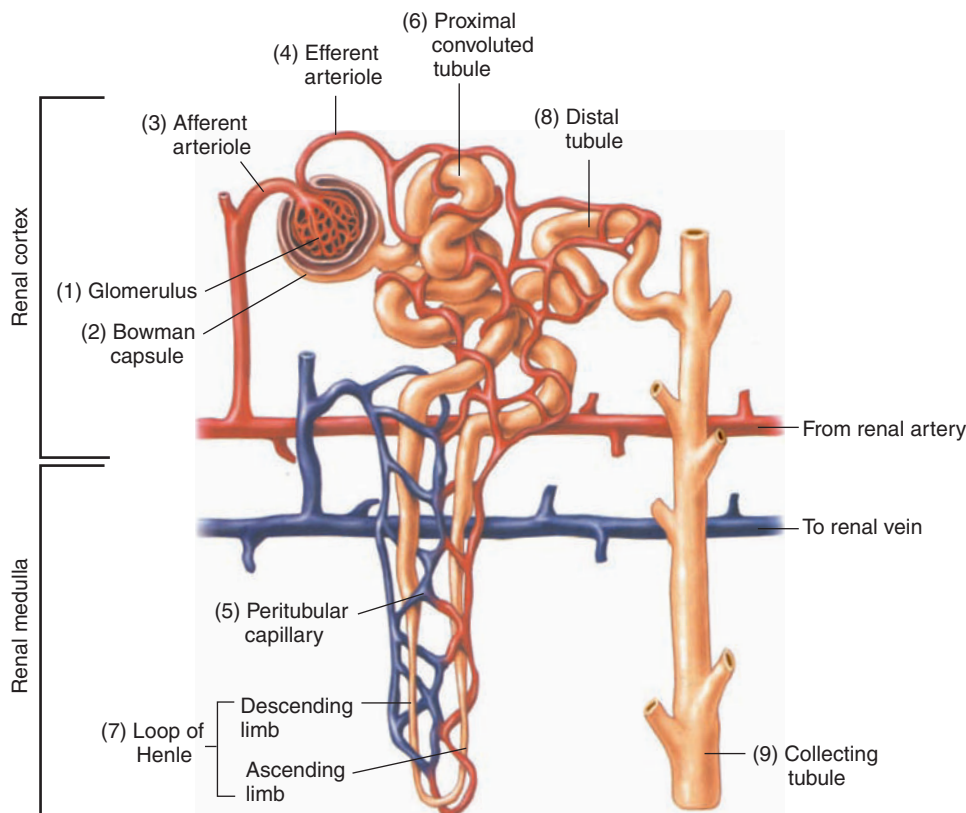
Waste material, now in the form of urine, passes to a hollow chamber, the (7) **renal pelvis**. This cavity is formed where the (8) **ureter** merges with the kidney. Each ureter is a slender tube about 10 inches to 12 inches long. They each carry urine in **peristaltic waves** to the bladder. Urine enters the bladder at the (9) **ureteral orifice**. The (10) **urinary bladder**, an expandable hollow organ,

acts as a temporary reservoir for urine. The bladder has small folds called *rugae* that expand as the bladder fills. A triangular area at the base of the bladder called the *trigone* is delineated by the openings of the ureters and the urethra.

The base of the trigone forms the (11) **urethra**, a tube that discharges urine from the bladder. The length of the urethra is approximately 1.5 inches in women and about 7 to 8 inches in men. In the male, the urethra passes through the prostate gland and the penis. During urination (**micturition**), urine is expelled from the body through the urethral opening, the (12) **urinary meatus**.

### Nephron

Microscopic examination of kidney tissue reveals the presence of approximately 1 million nephrons. (See Figure 11–2.) These microscopic structures are responsible for maintaining homeostasis by continually adjusting and regulating the contents of blood plasma. Substances removed by nephrons are nitrogenous wastes, the end products of protein metabolism, excess electrolytes, and many other products that exceed the amount tolerated by the body.



**Figure 11-2.** Nephron with its associated blood vessels.



Each nephron includes a renal corpuscle and a renal tubule. The **renal corpuscle** is composed of a tuft of capillaries called the (1) **glomerulus** and a modified, enlarged extension of the renal tubule known as (2) **Bowman capsule** that encapsulates the glomerulus. A larger (3) **afferent arteriole** carries blood to the glomerulus, and a smaller (4) **efferent arteriole** carries blood from the glomerulus. The difference in the size of these vessels provides the needed pressure to force blood **plasma** into Bowman capsule. Once this happens, the fluid is no longer plasma but is called **filtrate**. As the efferent arteriole passes behind the renal corpuscle, it forms the (5) **peritubular capillaries**. Each renal tubule consists of four sections: the (6) **proximal convoluted tubule**, followed by the narrow (7) **loop of Henle**, then the larger (8) **distal tubule** and, finally, the (9) **collecting tubule**. The collecting tubule transports newly formed urine to the renal pelvis for excretion by the kidneys.

The nephron performs three physiological functions as it produces urine:

- **Filtration** occurs in the renal corpuscle, where plasma containing water, electrolytes, sugar, and other small molecules is forced from the blood within the glomerulus into Bowman capsule to form filtrate.
- **Reabsorption** begins as filtrate travels through the long, twisted pathway of the tubule. Most of the water and some of the electrolytes and amino acids are returned to the peritubular capillaries and reenter the circulating blood.
- **Secretion** is the final stage of urine formation. Substances are actively secreted from the blood in the peritubular capillaries into the filtrate in the renal tubules. Waste products, such as ammonia, uric acid, and metabolic products of medications are secreted into the filtrate to be eliminated in the urine.

Urine leaves the collecting tubule and enters the renal pelvis. From here it passes to the bladder until urination takes place.



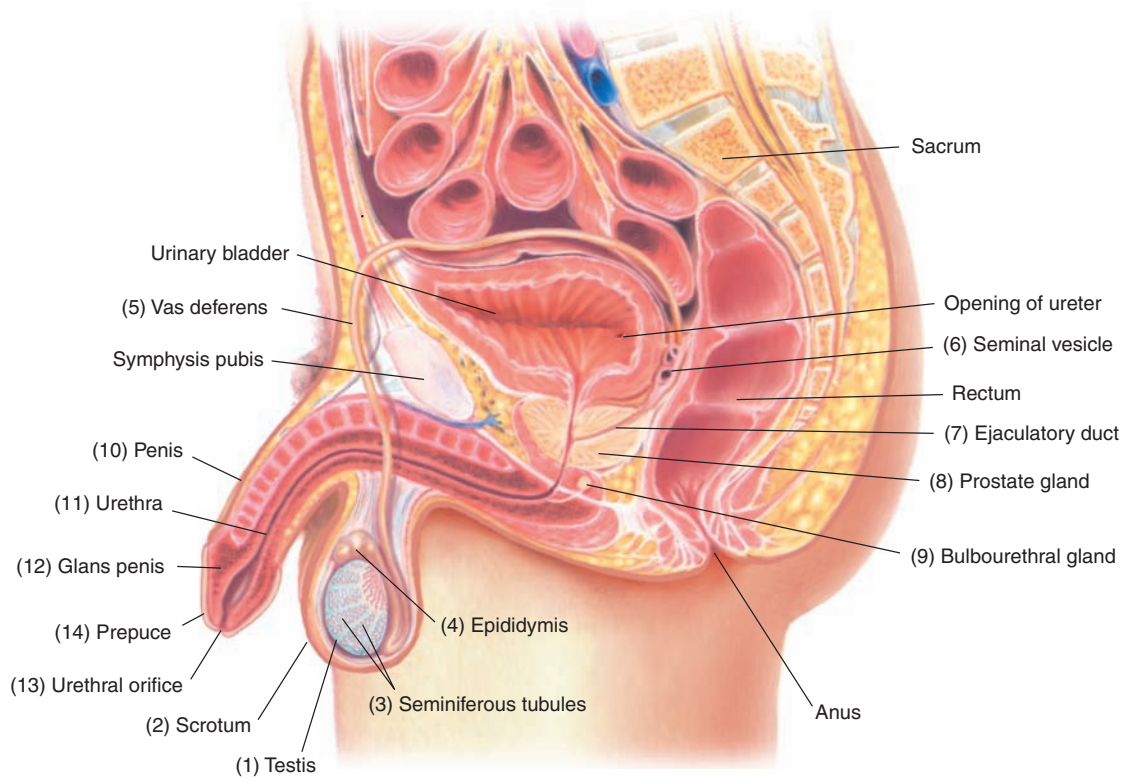
*It is time to review urinary system anatomy by completing Learning Activity 11–1.*

## Male Reproductive System

The purpose of the male reproductive system is to produce, maintain, and transport sperm, the male sex cell required for fertilization of the female egg. It also produces the male hormone **testosterone**, which is essential to the development of sperm and male secondary sex characteristics. (See Figure 11–3.)

The primary male reproductive organ consists of two (1) **testes** (singular, *testis*) located in an external sac called the (2) **scrotum**. Within the testes are numerous small tubes that twist and coil to form (3) **seminiferous tubules**, which produce sperm. The testes also secrete testosterone, a hormone that develops and maintains secondary sex characteristics. Lying over the superior surface of each testis is a single, tightly coiled tube, the (4) **epididymis**. This structure stores sperm after it leaves the seminiferous tubules. The epididymis is the first duct through which sperm passes after its production in the testes. Tracing the duct upward, the epididymis forms the (5) **vas deferens** (also called the **seminal duct** or **ductus deferens**), a narrow tube that passes through the inguinal canal into the abdominal cavity. The vas deferens extends over the top and down the posterior surface of the bladder, where it joins the (6) **seminal vesicle**.

The union of the vas deferens with the duct from the seminal vesicle forms the (7) **ejaculatory duct**. The seminal vesicle contains nutrients that support sperm viability and produces approximately 60% of the seminal fluid that is ultimately ejaculated during sexual intercourse (**coitus**). The ejaculatory duct passes at an angle through the (8) **prostate gland**, a triple-lobed organ fused to the base of the bladder. The prostate gland secretes a thin, alkaline substance that accounts for about 30% of seminal fluid. Its alkalinity helps protect sperm from the acidic environments of the male urethra and the female vagina. Two pea-shaped structures, the (9) **bulbourethral (Cowper) glands**, are located below the prostate and are connected by a small duct to the urethra. The bulbourethral glands provide the alkaline fluid necessary for sperm viability. The (10) **penis** is the male organ of copulation. It is cylindrical and composed of erectile tissue that encloses the (11) **urethra**. The urethra expels **semen** and urine from the body. During ejaculation, the sphincter at the base of the bladder closes, which not only stops the urine from being expelled with the semen, but also prevents semen from entering the bladder. The enlarged tip of the penis, the (12) **glans penis**, contains the (13) **urethral orifice (meatus)**. A movable hood of skin, called the (14) **prepuce (foreskin)** covers the glans penis.



**Figure 11-3.** Midsagittal section of male reproductive structures shown through the pelvic cavity.

## Connecting Body Systems—Genitourinary System

*The main function of the genitourinary system is to enable sexual reproduction and to regulate extracellular fluids of the body. Specific functional relationships between the genitourinary system and other body systems are summarized below.*



### Blood, lymph, and immune

- Male reproductive system transports testosterone throughout the body in blood and lymph.
- Kidneys regulate composition and quality of blood plasma and lymph.
- Kidneys retain needed products and remove those that are excessive or toxic to the body.



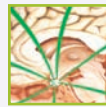
### Cardiovascular

- Kidneys help regulate essential electrolytes needed for contraction of the heart.



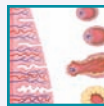
### Digestive

- Kidneys aid in removing glucose from the blood when excessive amounts are consumed.
- Kidneys remove excessive fluids absorbed from the gastrointestinal (GI) tract.



### Endocrine

- Kidneys regulate sodium and water balance, which is essential for hormone transport in the blood.
- Kidneys produce erythropoietin, a hormone synthesized mainly in the kidneys and released into the bloodstream.
- Gonads produce hormones that provide feedback to influence pituitary function.



### Female reproductive

- Male organs of reproduction work in conjunction with the female reproductive system to enable fertilization of the ovum.
- Kidneys aid in removing waste products produced by the fetus in the pregnant woman.

## Connecting Body Systems—Genitourinary System



### Integumentary

- Kidneys compensate for extracellular fluid loss due to hyperhidrosis.
- Kidneys adjust electrolytes, especially potassium and sodium, in response to their loss through the dermis.



### Nervous

- Kidneys regulate sodium, potassium, and calcium, which are the electrolytes responsible for the transmission of nervous stimuli.



### Musculoskeletal

- Kidneys work in conjunction with bone tissue to maintain a constant calcium level.



### Respiratory

- Kidneys and lungs assist in regulating acid-base balance of the body.



*It is time to review male reproductive anatomy by completing Learning Activity 11–2.*

## Medical Word Elements

*This section introduces combining forms, suffixes, and prefixes related to the genitourinary system. Word analyses are also provided.*

Element	Meaning	Word Analysis
<i>Combining Forms</i>		
<b>Urinary System</b>		
cyst/o	bladder	<b>cyst/o</b> /scope (SĪST-ō-skōp): instrument for examining the bladder -scope: instrument for examining
vesic/o		<b>vesic/o</b> /cele (VĒS-ī-kō-sēl): hernia of the bladder; also called <i>cystocele</i> -cele: hernia, swelling <i>With a vesicocele, the bladder herniates into the vaginal wall, which may lead to incomplete emptying of the bladder.</i>
glomerul/o	glomerulus	<b>glomerul/o</b> /pathy (glō-mēr-ū-LŌP-ă-thē): disease of the glomerulus -pathy: disease
lith/o	stone, calculus	<b>lith/o</b> /tripsy (LĪTH-ō-trīp-sē): crushing of a stone -tripsy: crushing <i>The most common method of lithotripsy is extracorporeal shock wave lithotripsy (ESWL). When stones are large or ESWL is not recommended, percutaneous nephrolithotomy or ureteroscopic stone removal are alternate methods of treatment.</i>
meat/o	opening, meatus	<b>meat/o</b> /tomy (mē-ă-TŌT-ō-mē): incision of the meatus -tomy: incision <i>A meatotomy is performed to relieve stenosis of the urethra, which may inhibit the proper passage of urine or semen.</i>
nephr/o	kidney	<b>nephr/o</b> /pexy (NĒF-rō-pēks-ē): fixation of kidney -pexy: fixation (of an organ)
ren/o		<b>ren/al</b> (RĒ-nāl): pertaining to the kidney -al: pertaining to

(continued)

Medical Word Elements—cont'd		
Element	Meaning	Word Analysis
pyel/o	renal pelvis	<b>pyel/o</b> /plasty (PĪ-ě-lō-plās-tē): surgical repair of the renal pelvis - <i>plasty</i> : surgical repair
ur/o	urine, urinary tract	<b>ur/o</b> /lith (Ū-rō-lĭth): stone in urinary tract - <i>lith</i> : stone, calculus
ureter/o	ureter	<b>ureter</b> /ectasis (ū-rē-tēr-ĔĖK-tă-sĭs): dilation of the ureter - <i>ectasis</i> : dilation, expansion
urethr/o	urethra	<b>urethr/o</b> /stenosis (ū-rē-thrō-stĕn-Ō-sĭs): narrowing or stricture of the urethra - <i>stenosis</i> : narrowing, stricture
<b>Male Reproductive System</b>		
andr/o	male	<b>andr/o</b> /gen/ic (ān-drō-JĔN-ĭk): pertaining to maleness <i>gen</i> : forming, producing, origin - <i>ic</i> : pertaining to <i>Androgenic hormones include all natural or synthetic compounds that stimulate or maintain male characteristics. The most common androgenic hormone is testosterone.</i>
balan/o	glans penis	<b>balan/o</b> /plasty (BĀL-ă-nō-plās-tē): surgical repair of the glans penis - <i>plasty</i> : surgical repair
epididym/o	epididymis	<b>epididym/o</b> /tomy (ĕp-ĭ-dĭd-ĭ-MŌT-ō-mē): incision of the epididymis - <i>tomy</i> : incision
orch/o	testis (plural, testes)	<b>orch</b> /itis (or-KĪ-tĭs): inflammation of testes - <i>itis</i> : inflammation <i>A common cause of orchitis in young boys is a mumps infection.</i>
orchi/o		<b>orchi</b> /algia (or-kē-ĀL-jē-ă): pain in the testes - <i>algia</i> : pain
orchid/o		<b>orchid/o</b> /ptosis (or-kĭd-ōp-TŌ-sĭs): downward displacement of the testes - <i>ptosis</i> : prolapse, downward displacement
test/o		<b>test</b> /ectomy (tĕs-TĔK-tō-mē): excision of a testis - <i>ectomy</i> : excision, removal
perine/o	perineum (area between scrotum [or vulva in the female] and anus)	<b>perine</b> /al (pĕr-ĭ-NĔ-ăl): pertaining to the perineum - <i>al</i> : pertaining to
prostat/o	prostate gland	<b>prostat/o</b> /megaly (prōs-tă-tō-MĔG-ă-lē): enlargement of the prostate gland - <i>megaly</i> : enlargement
spermat/o	spermatozoa, sperm cells	<b>spermat/o</b> /cele (spĕr-MĀT-ō-sĕl): swelling containing spermatozoa - <i>cele</i> : hernia, swelling <i>A spermatocele is usually an epididymal cyst commonly containing sperm.</i>



Medical Word Elements—cont'd		
Element	Meaning	Word Analysis
sperm/o		<b>sperm/ic</b> (SPĚR-mĭk): pertaining to sperm cells -ic: pertaining to
varic/o	dilated vein	<b>varic/o/cele</b> (VĀR-ĭ-kō-sĕl): swelling of a dilated vein -cele: hernia, swelling <i>Varicocele is a dilation of the veins of the spermatic cord, the structure that supports the testicles.</i>
vas/o	vessel; vas deferens; duct	<b>vas/ectomy</b> (vās-ĔK-tō-mĕ): removal of (all or part of) the vas deferens -ectomy: excision, removal <i>Bilateral vasectomy is a surgical procedure to produce sterility in the male.</i>
vesicul/o	seminal vesicle	<b>vesicul/itis</b> (vē-sĭk-ŭ-LĪ-tĭs): inflammation of the seminal vesicle -itis: inflammation
<b>Other</b>		
albumin/o	albumin, protein	<b>albumin/oid</b> (āl-BŪ-mĭ-noyd): resembling albumin -oid: resembling
azot/o	nitrogenous compounds	<b>azot/emia</b> (āz-ō-TĔ-mĕ-ā): nitrogenous compounds in the blood -emia: blood condition <i>Nitrogenous products, especially urea, are toxic. If they are not removed from the body, death will result.</i>
bacteri/o	bacteria (singular, <i>bacterium</i> )	<b>bacteri/uria</b> (bāk-tĕ-rĕ-Ū-rĕ-ā): bacteria in urine -uria: urine
crypt/o	hidden	<b>crypt/orchid/ism</b> (krĭpt-OR-kĭd-ĭzm): condition of hidden testes; also called <i>cryptorchism</i> <i>orchid</i> : testis (plural, testes) -ism: condition <i>Cryptorchidism is the failure of the testes to descend into the scrotum; usually a congenital disorder.</i>
gonad/o	gonads, sex glands	<b>gonad/o/pathy</b> (gōn-ā-DŎP-ā-thĕ): disease of the sex glands -pathy: disease
kal/i	potassium (an electrolyte)	<b>hypo/kal/emia</b> (hĭ-pō-k ā-LĔ-mĕ-ā): abnormally low concentration of potassium in the blood <i>hypo-</i> : under, below -emia: blood condition <i>Hypokalemia may result from excessive urination, which depletes potassium from the body.</i>
keton/o	ketone bodies (acids and acetones)	<b>keton/uria</b> (kĕ-tō-NŪ-rĕ-ā): presence of ketone bodies in the urine -uria: urine <i>Ketonuria is commonly found in diabetes mellitus, starvation, and excessive dieting.</i>

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Medical Word Elements—cont'd		
Element	Meaning	Word Analysis
noct/o	night	<b>noct</b> /uria (nŏk-TŪ-rē-ă): excessive and frequent urination after going to bed -uria: urine <i>Nocturia is associated with prostate disease, urinary tract infection, and uncontrolled diabetes.</i>
olig/o	scanty	<b>olig</b> /o/sperm/ia (ŏl-ĭ-gŏ-SPĔR-mē-ă): scanty (decreased production) of sperm <i>sperm</i> : spermatozoa, sperm cells -ia: condition
py/o	pus	<b>py</b> /o/rrhea (pī-ŏ-RE-ă): flow or discharge of pus -rrhea: discharge, flow
Suffixes		
-cide	killing	sperm/i/ <b>cide</b> (SPĔR-mĭ-sĭd): (agents that) kill sperm; also called <i>spermicide</i> <i>sperm/i</i> : spermatozoa, sperm cells
-genesis	forming, producing, origin	lith/o/ <b>genesis</b> (lĭth-ŏ-JĔN-ĕ-sĭs): forming or producing stones <i>lith/o</i> : stone, calculus
-iasis	abnormal condition (produced by something specified)	lith/ <b>iasis</b> (lĭth-Ī-ă-sĭs): abnormal condition of stones or calculi <i>lith/o</i> : stone, calculus
-ism	condition	an/orch/ <b>ism</b> (ăn-OR-kĭzm): condition without testes <i>an-</i> : without, not <i>orch</i> : testis (plural, testes) <i>Anorchism is the congenital or acquired absence of one or both testes.</i>
-spadias	slit, fissure	hypo/ <b>spadias</b> (hĭ-pŏ-SPĀ-dē-ăs): a fissure under (the penis) <i>hypo-</i> : under, below <i>Hypospadias is a congenital defect in which the urethra opens on the underside of the glans penis instead of the tip.</i>
-uria	urine	poly/ <b>uria</b> (pŏl-ē-Ū-rē-ă): much (excretion of) urine <i>poly-</i> : many, much <i>Polyuria is generally considered to be the excretion of over 2.5 liters per 24 hours.</i>
Prefixes		
dia-	through, across	<b>dia</b> /lysis (dĭ-ĀL-ĭ-sĭs): separation across -lysis: separation; destruction; loosening <i>Renal dialysis is a procedure that uses a membrane to separate and selectively remove waste products from blood when kidneys are unable to complete this function.</i>
retro-	backward, behind	<b>retro</b> /peritone/al (rĕt-rŏ-pĕr-ĭ-tŏ-NĔ-ăl): pertaining to (the area) behind the peritoneum <i>peritone</i> : peritoneum -al: pertaining to



It is time to review medical word elements by completing Learning Activity 11–3. For audio pronunciations of the above-listed key terms, you can visit [www.davisplus.fadavis.com/gylys/systems](http://www.davisplus.fadavis.com/gylys/systems) to download this chapter's Listen and Learn! exercises or use the book's audio CD (if included).

## Pathology

Pathology of the urinary system includes a range of disorders from those that are asymptomatic to those that manifest an array of signs and symptoms. Causes for these disorders include congenital anomalies, infectious diseases, trauma, or conditions that secondarily involve the urinary structures. Many times, asymptomatic urinary diseases are first diagnosed when a routine urinalysis shows abnormalities. Forms of glomerulonephritis and chronic urinary tract infection are two such disorders. Symptoms specific to urinary disorders include changes in urination pattern, output, or dysuria. Endoscopic tests, radiological evaluations, and laboratory tests that evaluate renal function are typically employed to diagnose disorders of the urinary system.

Signs and symptoms of male reproductive disorders include pain, swelling, erectile dysfunction, and loss of normal sexual drive (**libido**). Characteristics of infectious diseases, especially those transmitted through sexual activity, commonly include pain, discharge, or lesions as well as a vague feeling of fullness or discomfort in the perineal or rectal area. A complete evaluation of the genitalia, reproductive history, and past and present genitourinary infections and disorders is necessary to identify disorders associated with male reproductive structures.

For diagnosis, treatment, and management of genitourinary disorders, the medical services of a specialist may be warranted. **Urology** is the branch of medicine concerned with male and female urinary disorders and diseases of the male reproductive system. The physician who specializes in diagnoses and treatment of genitourinary disorders is known as a **urologist**. However, the branch of medicine concerned specifically with diseases of the kidney, electrolyte imbalance, renal transplantation, and dialysis therapy is known as **nephrology**. Physicians who practice in this specialty are called **nephrologists**.

## Pyelonephritis

One of the most common forms of kidney disease is **pyelonephritis**, (also called **kidney infection** or **complicated urinary tract infection**). In this disorder, bacteria invade the renal pelvis and kidney tissue, commonly as a result of a bladder infection that has ascended to the kidney via the ureters. When the infection is severe, lesions form in the renal pelvis, causing bleeding. The microscopic examination of urine shows large quantities of bacteria (**bacteriuria**), white blood cells (**pyuria**), and, when

lesions are present, red blood cells (**hematuria**). The onset of the disease is usually acute, with symptoms including pain around the kidney, dysuria, fatigue, urinary urgency and frequency, chills, fever, nausea, and vomiting. Treatment with antibiotics is usually successful. However, in some cases, organisms may have developed a resistance and alternative antibiotics may be required.

## Glomerulonephritis

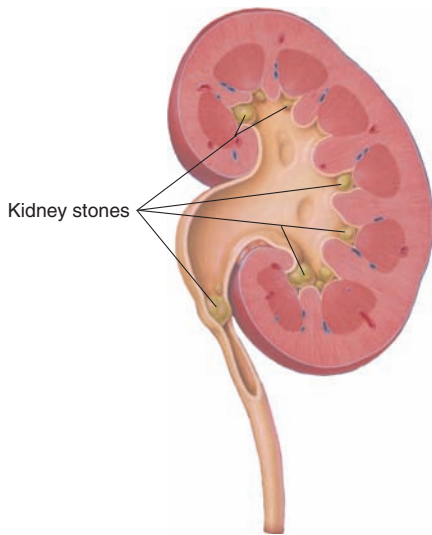
Any condition that causes the glomerular walls to become inflamed is referred to as **glomerulonephritis**. One of the most common causes of glomerular inflammation is a reaction to the toxins given off by pathogenic bacteria, especially streptococci that have recently infected another part of the body, usually the throat. Glomerulonephritis is also associated with diabetes and autoimmune diseases such as systemic lupus erythematosus, polyarthritis, and scleroderma.

When the glomerular membrane is inflamed, it becomes “leaky” (**permeable**). Red blood cells and protein pass through the glomerulus and enter the tubule. In some cases, protein solidifies in the nephron tubules and forms solid masses that take the shape of the tubules in which they develop. These masses are called **casts**. They commonly pass out of the kidney by way of the urine and may be visible when urine is examined microscopically. The clinical picture for glomerulonephritis includes blood and protein in the urine (**hematuria** and **proteinuria**) and red cell casts, along with high blood pressure (**hypertension (HTN)**), edema, and impaired renal function. Most patients with acute glomerulonephritis associated with a streptococcal infection recover with no lasting kidney damage.

## Nephrolithiasis

Stones (**calculi**) may form in any part of the urinary tract (**urolithiasis**), but most arise in the kidney, a condition called **nephrolithiasis**. (See Figure 11–4.) They commonly form when dissolved urine salts begin to solidify. These stones may increase in size and obstruct urinary structures. If they lodge in the ureters, they cause intense throbbing pain called **colic**. Because urine is hindered from passing into the bladder, it flows backward (**refluxes**) into the renal pelvis and the tubules, causing them to dilate.

In one method of treatment called **extracorporeal shock wave lithotripsy (ESWL)**, calculi are pulverized using concentrated ultrasound waves,



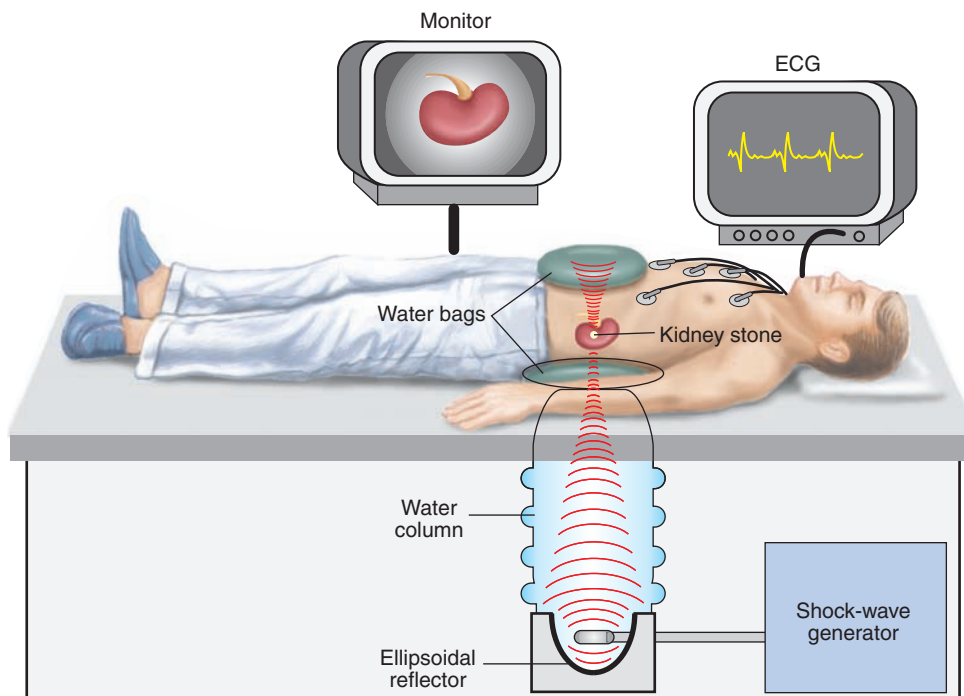
**Figure 11-4.** Kidney stones in the calices and ureter.

called *shock waves*, directed at the stones from a machine outside the body. (See Figure 11-5.) For excessively large stones or patients who have contraindications for ESWL, an alternative treatment is **percutaneous nephrolithotomy (PCNL)**. In this procedure, a small incision is made in the skin, and an opening is formed in the kidney. A nephroscope is inserted into the kidney to locate and

remove the stone. If the stone is large, an ultrasonic or electrohydraulic probe is used to break the stone into smaller fragments, which are then more easily removed. A nephrostomy tube may be inserted and remain in place during healing. For stones that have descended into the ureters, it may be possible to remove them using a specialized ureteroscope fitted with a small basket. The ureteroscope is passed through the urethra and bladder and into the ureter where the basket collects the stone. For larger stones, it may be necessary to break them into smaller pieces using an endoscope fitted with a laser beam before the fragments are removed. This procedure is called **ureteroscopic stone removal**, and no incision is required.

## Benign Prostatic Hyperplasia

**Benign prostatic hyperplasia (BPH)**, also called *nodular hyperplasia* or *benign prostatic hypertrophy*, is commonly associated with the aging process. As the prostate gland enlarges, it decreases the urethral lumen, and complete voiding of urine becomes difficult. Urine that remains in the bladder commonly becomes a breeding ground for bacteria. Bladder infection (**cystitis**) and, ultimately, kidney infection (**nephritis**) may result. If medical management of BPH fails, it may be necessary to employ surgical methods. Surgical removal of



**Figure 11-5.** Extracorporeal shock wave lithotripsy.

the entire prostate may be done through the perineum (**perineal prostatectomy**) or an abdominal opening above the pubis and directly over the bladder (**suprapubic prostatectomy**). These procedures are invasive and are performed when the entire prostate must be removed, such as when cancer is identified. These methods also enable the removal of lymph nodes for examination. When only a portion of the prostate must be removed, the less invasive **transurethral resection of the prostate (TURP)** is usually performed. In TURP, a resectoscope is inserted through the urethra, and a small loop “chips away” some of the obstructing tissue. At the conclusion of the surgery, the urethra and bladder are irrigated to remove the small chips. (See Figure 11-6.)

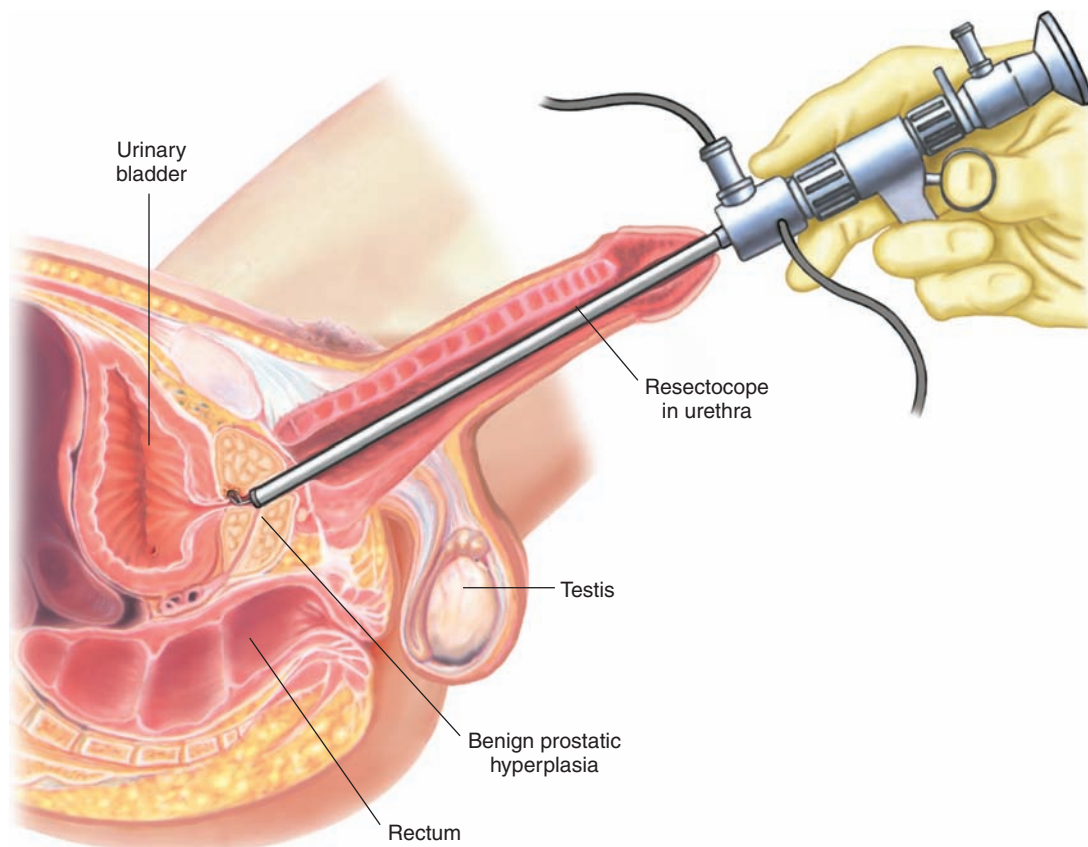
## Cryptorchidism

Failure of the testes to descend into the scrotal sac prior to birth is called **cryptorchidism**. In many infants born with this condition, the testes descend spontaneously by the end of the first year. If this does not occur, correction of the

disorder involves surgical suspension of the testes (**orchiopexy**) in the scrotum. This procedure is usually done before the child reaches age 2. Because an inguinal hernia commonly accompanies cryptorchidism, the hernia may be sutured (**herniorrhaphy**) at the same time.

## Acute Tubular Necrosis

In **acute tubular necrosis (ATN)**, the tubular portion of the nephron is injured by a decrease in blood supply (**ischemic ATN**) or after the ingestion of toxic chemicals (**nephrotoxic ATN**). Ischemia may occur because of circulatory collapse, severe hypotension, hemorrhage, dehydration, or other disorders that affect blood supply. ATN does not produce specific signs and symptoms, and diagnosis relies on a positive history of risk factors. General signs and symptoms of ATN include scanty urine production (**oliguria**) fluid retention, mental apathy, nausea, vomiting, and increased blood levels of calcium (**hypercalcemia**). When tubular damage is not severe, the disorder is usually reversible.



**Figure 11-6.** Transurethral resection of the prostate (TURP).

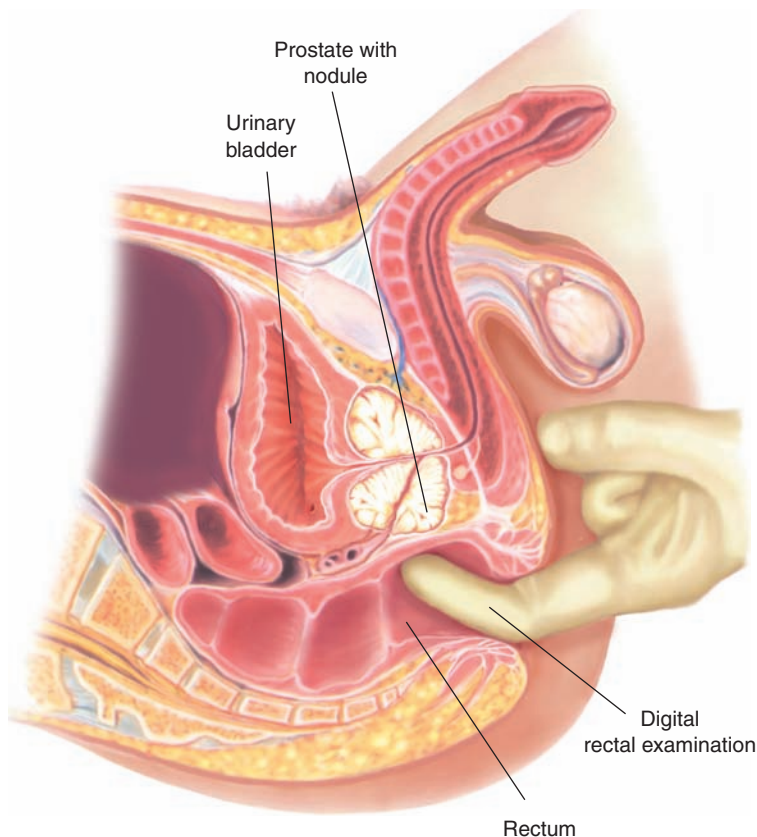


## Oncology

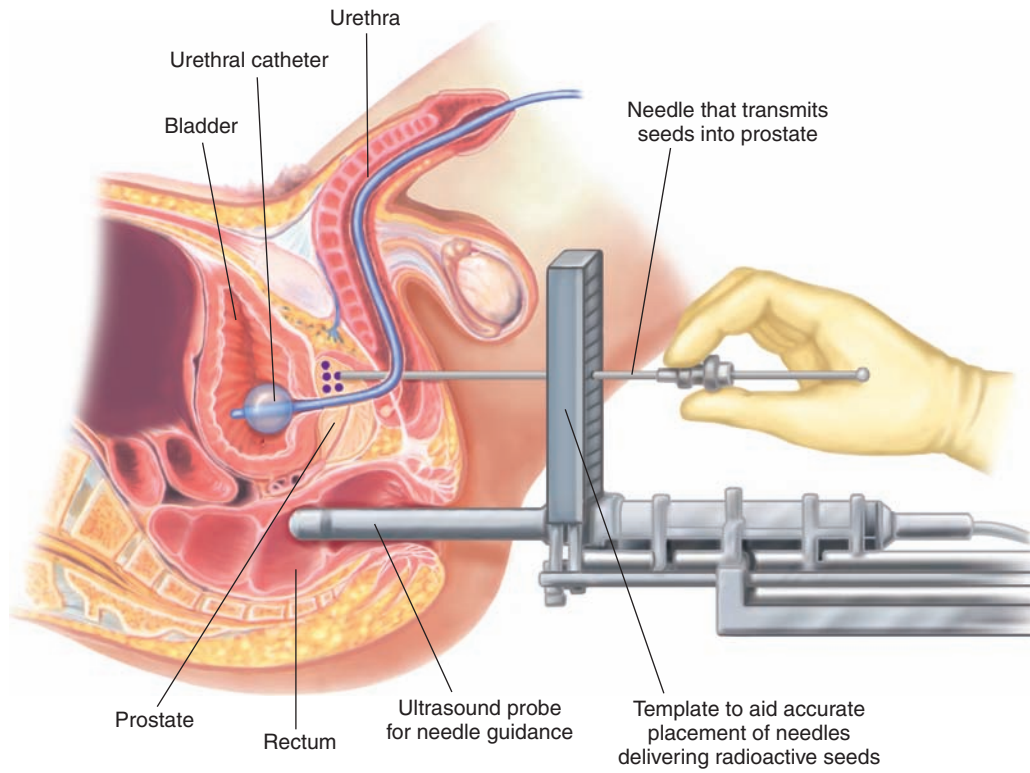
The most common form of cancer in men is carcinoma of the prostate. In the United States, the disease is rarely found in men younger than age 50; however, the incidence dramatically increases with age. Symptoms include difficulty starting urination (**hesitancy**) and stopping the urinary stream, dysuria, urinary frequency, and hematuria. By the time these symptoms develop and the patient seeks treatment, the disease is quite advanced and long-term survival is not likely. Early pre-symptomatic tests include a blood test for prostate-specific antigen (PSA) and periodic digital rectal examination (DRE). (See Figure 11-7.)

Like other forms of cancer, prostatic carcinomas are staged and graded to determine metastatic potential, response to treatment, chances of survival, and appropriate forms of therapy. Surgery and radiation therapy are usual treatment modalities, but other forms of treatment may also be employed. Surgical treatment includes the removal of

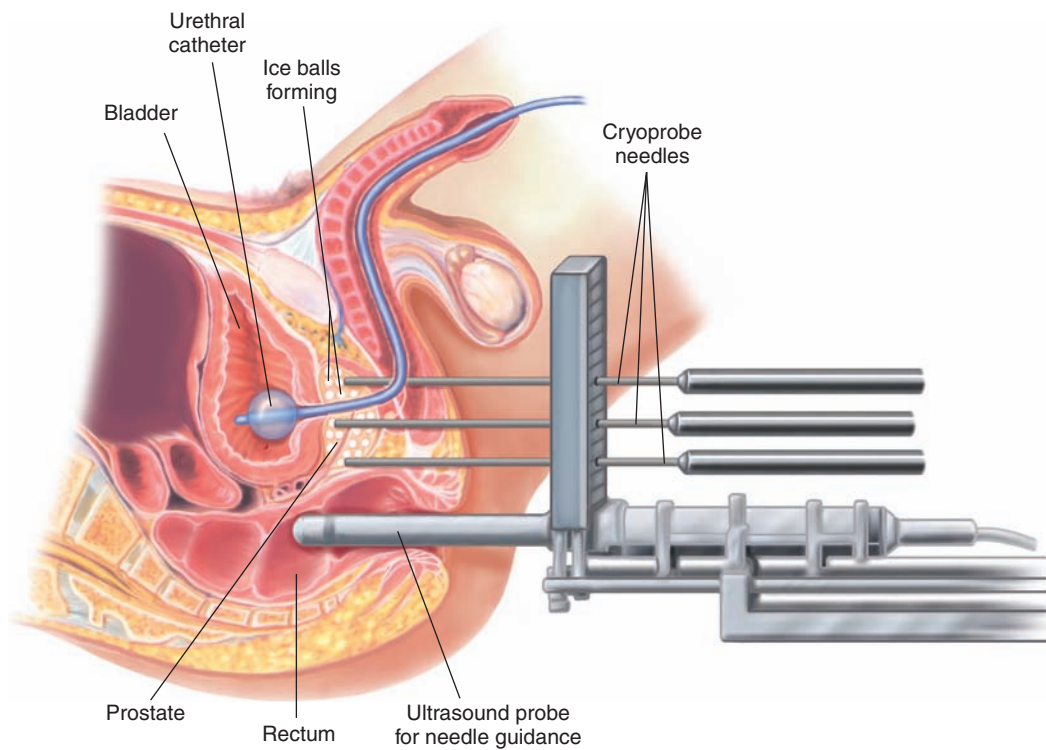
the entire prostate (**radical prostatectomy**). Two forms of radiation oncology include brachytherapy and external beam radiation. In **brachytherapy** (also called **internal radiation therapy**), radioactive “seeds” are placed directly in the malignant tissue. They remain in place for long or short periods of time depending on the type of malignancy, its location, and other diagnostic criteria. (See Figure 11-8.) In **external beam radiation (EBR)**, high-energy x-ray beams are generated by a machine and directed at the tumor from outside the body to destroy prostate tissue. Another treatment modality is the application of extreme cold (**cryosurgery**), which results in the destruction of prostate tissue. (See Figure 11-9.) Administering antiandrogenic agents as well as hormones that deplete the body of testicular hormones (**combined hormonal therapy**) has been effective in treatment at the early stages of the disease. Because prostatic cancer is stimulated by testosterone, surgical removal of the testes (**bilateral orchiectomy**) may be necessary.



**Figure 11-7.** Digital rectal examination.



**Figure 11-8.** Brachytherapy.



**Figure 11-9.** Cryosurgery of the prostate.

## Diagnostic, Symptomatic, and Related Terms

*This section introduces diagnostic, symptomatic, and related terms and their meanings. Word analyses for selected terms are also provided.*

Term	Definition
<b>Urinary System</b>	
<b>anuria</b> ăn-Ū-rē-ă <i>an-</i> : without, not <i>uria</i> : urine	Absence of urine production or urinary output <i>Anuria may be obstructive, in which there is blockage proximal to the bladder, or unobstructive, which is caused by severe damage to the nephrons of the kidneys.</i>
<b>azotemia</b> ăz-ō-TĒ-mē-ă <i>azot</i> : nitrogenous compounds <i>-emia</i> : blood condition	Retention of excessive amounts of nitrogenous compounds (urea, creatinine, and uric acid) in the blood; also called <i>uremia</i>
<b>bladder neck obstruction (BNO)</b>	Blockage at base of the bladder that reduces or prevents urine from passing into the urethra <i>BNO can be caused by benign prostatic hyperplasia, bladder stones, bladder tumors, or tumors in the pelvic cavity.</i>
<b>chronic renal failure</b> KRŌ-nĭk RĒ-năl	Renal failure that occurs over a period of years, in which the kidneys lose their ability to maintain volume and composition of body fluids with normal dietary intake <i>Chronic renal failure is the result of decreased numbers of functioning nephrons in the kidneys.</i>
<b>dysuria</b> dĭs-Ū-rē-ă <i>dys-</i> : bad; painful; difficult <i>uria</i> : urine	Painful or difficult urination, commonly described as a “burning sensation” while urinating <i>Dysuria is a symptom of numerous conditions but, most commonly, urinary tract infection (UTI).</i>
<b>end-stage renal disease (ESRD)</b> dĭ-ĂL-ĭ-sĭs <i>dia-</i> : through, across <i>-lysis</i> : separation; destruction; loosening	Condition in which kidney function is permanently lost
<b>enuresis</b> ɛn-ŭ-RĒ-sĭs <i>en-</i> : in, within <i>ur</i> : urine <i>-esis</i> : condition	Involuntary discharge of urine; also called <i>incontinence</i> <i>Enuresis that occurs during the night is called nocturnal enuresis; during the day, diurnal enuresis.</i>
<b>fistula</b> FĭS-tŭ-lă	Abnormal passage from a hollow organ to the surface or from one organ to another <i>The most common type of urinary fistula is the vesicovaginal fistula where communication occurs between the bladder and vagina. Its causes include previous pelvic surgery such as hysterectomy, difficult and prolonged labor, or reduced blood supply to the area.</i>
<b>frequency</b> FRĒ-kwĕn-sĕ	Voiding urine at frequent intervals

## Diagnostic, Symptomatic, and Related Terms—cont'd

Term	Definition
<b>hesitancy</b> HĒZ-ĭ-tĕn-sĕ	Involuntary delay in initiating urination
<b>hydronephrosis</b> hĭ-drō-nĕf-RŌ-sĭs <i>hydr/o:</i> water <i>neph:</i> kidney <i>-osis:</i> abnormal condition; increase (used primarily with blood cells)	<p>Abnormal dilation of the renal pelvis and the calyces of one or both kidneys due to pressure from accumulated urine that cannot flow past an obstruction in the urinary tract</p> <p><i>The most common causes of hydronephrosis are BPH, urethral strictures, and calculi that lodge in the ureter and cause an obstruction. The pressure impairs, and may eventually interrupt, kidney function. (See Figure 11-10.)</i></p>
<b>Figure 11-10.</b> Hydronephrosis and hydroureter.	
<b>nephrotic syndrome</b> nĕ-FRŌT-ĭk <i>neph/o:</i> kidney <i>-tic:</i> pertaining to, relating to	<p>Loss of large amounts of plasma protein, usually albumin by way of urine due to increased permeability of the glomerular membrane</p> <p><i>Hypoproteinemia, edema, and hyperlipidemia are commonly associated with nephrotic syndrome.</i></p>
<b>nocturia</b> nŏk-TŪ-rĕ-ă <i>noct:</i> night <i>-uria:</i> urine	<p>Excessive or frequent urination after going to bed</p> <p><i>Nocturia is typically caused by excessive fluid intake, uncontrolled diabetes mellitus, urinary tract infection, prostate disease, impaired renal function, or the use of diuretics.</i></p>

(continued)

Diagnostic, Symptomatic, and Related Terms—cont'd	
Term	Definition
<b>oliguria</b> ōl-ĭg-Ū-rē-ă <i>olig</i> : scanty <i>-uria</i> : urine	Diminished capacity to form and pass urine, resulting in inefficient excretion of the end products of metabolism  <i>Oliguria is usually caused by fluid and electrolyte imbalances, renal lesions, or urinary tract obstruction.</i>
<b>polycystic kidney disease (PKD)</b> pŏl-ē-SĪS-tĭk <i>poly</i> : many, much <i>cyst</i> : bladder <i>-ic</i> : pertaining to	Inherited disease in which sacs of fluid called <i>cysts</i> develop in the kidneys  <i>If cysts increase in number or size or if they become infected, kidney failure may result. Dialysis or kidney transplant may be necessary for renal failure caused by PKD.</i>
<b>urgency</b> ŪR-jĕn-sē	Feeling of the need to void immediately  <i>Urinary urgency commonly occurs in urinary tract infection (UTI).</i>
<b>vesicoureteral reflux (VUR)</b> vēs-ĭ-kō-ŭ-RĒ-tĕr-ăl <i>vesic/o</i> : bladder <i>ureter</i> : ureter <i>-al</i> : pertaining to	Disorder caused by the failure of urine to pass through the ureters to the bladder, usually due to impairment of the valve between the ureter and bladder or obstruction in the ureter  <i>VUR may result in the enlargement of the kidney (hydronephrosis) if the obstruction is in the proximal portion of the ureter or enlargement of the ureter (hydroureter) and the kidney if the obstruction is in the distal portion of the ureter.</i>
<b>Wilms tumor</b> VĪLMZ TOO-mĕr	Rapidly developing malignant neoplasm of the kidney that usually occurs in children  <i>Diagnosis of Wilms tumor is established by an excretory urogram (EU) with tomography. The tumor is well encapsulated in the early stage but may metastasize to other sites, such as lymph nodes and lungs, at later stages.</i>
<b>Male Reproductive System</b>	
<b>anorchidism</b> ăn-OR-kĭ-dĭzm <i>an-</i> : without, not <i>orchid</i> : testis (plural, testes) <i>-ism</i> : condition	Congenital absence of one or both testes; also called <i>anorchia</i> or <i>anorchism</i>  <i>Treatment for anorchidism requires replacement of the male hormone testosterone. Boys affected with anorchidism will need testosterone for puberty to occur.</i>
<b>aspermia</b> ă-SPĔR-mē-ă <i>a-</i> : without, not <i>sperm</i> : spermatozoa, sperm cells <i>-ia</i> : condition	Failure to form or ejaculate semen  <i>Aspermia should not be confused with azoospermia, which is absence of sperm in the ejaculate.</i>
<b>balanitis</b> bāl-ă-NĪ-tĭs <i>balan</i> : glans penis <i>-itis</i> : inflammation	Inflammation of the skin covering the glans penis  <i>Uncircumcised men with poor personal hygiene are prone to this disorder.</i>
<b>epispadias</b> ĕp-ĭ-SPĀ-dē-ăs <i>epi-</i> : above, upon <i>-spadias</i> : slit, fissure	Malformation in which the urethra opens on the dorsum of the penis



## Diagnostic, Symptomatic, and Related Terms—cont'd

Term	Definition
<b>erectile dysfunction (ED)</b> ě-RĚK-tīl	Repeated inability to initiate or maintain an erection sufficient for sexual intercourse  <i>Any disorder that causes injury to the nerves or impairs blood flow in the penis has the potential to cause ED.</i>
<b>hydrocele</b> HĪ-drō-sĕl <i>hydr/o</i> : water <i>-cele</i> : hernia, swelling	Accumulation of serous fluid in a saclike cavity, especially the testes and associated structures  <i>Hydrocele is common in male newborns but usually resolves within the first year.</i>
<b>hypospadias</b> hī-pō-SPĀ-dē-ās <i>hypo-</i> : under, below, deficient <i>-spadias</i> : slit, fissure	Developmental anomaly in which the urethra opens on the underside of the penis or, in extreme cases, on the perineum
<b>phimosis</b> fī-MŌ-sīs <i>phim</i> : muzzle <i>-osis</i> : abnormal condition; increase (used primarily with blood cells)	Stenosis or narrowing of preputial orifice so that the foreskin cannot be retracted over the glans penis
<b>sterility</b> stĕr-ĪL-ī-tē	Inability to produce offspring; in the male, inability to fertilize the ovum
<b>varicocele</b> VĀR-ī-kō-sĕl <i>varic/o</i> : dilated vein <i>-cele</i> : hernia, swelling	Swelling and distention of veins of the spermatic cord



*It is time to review pathological, diagnostic, symptomatic, and related terms by completing Learning Activity 11-4.*

## Diagnostic and Therapeutic Procedures

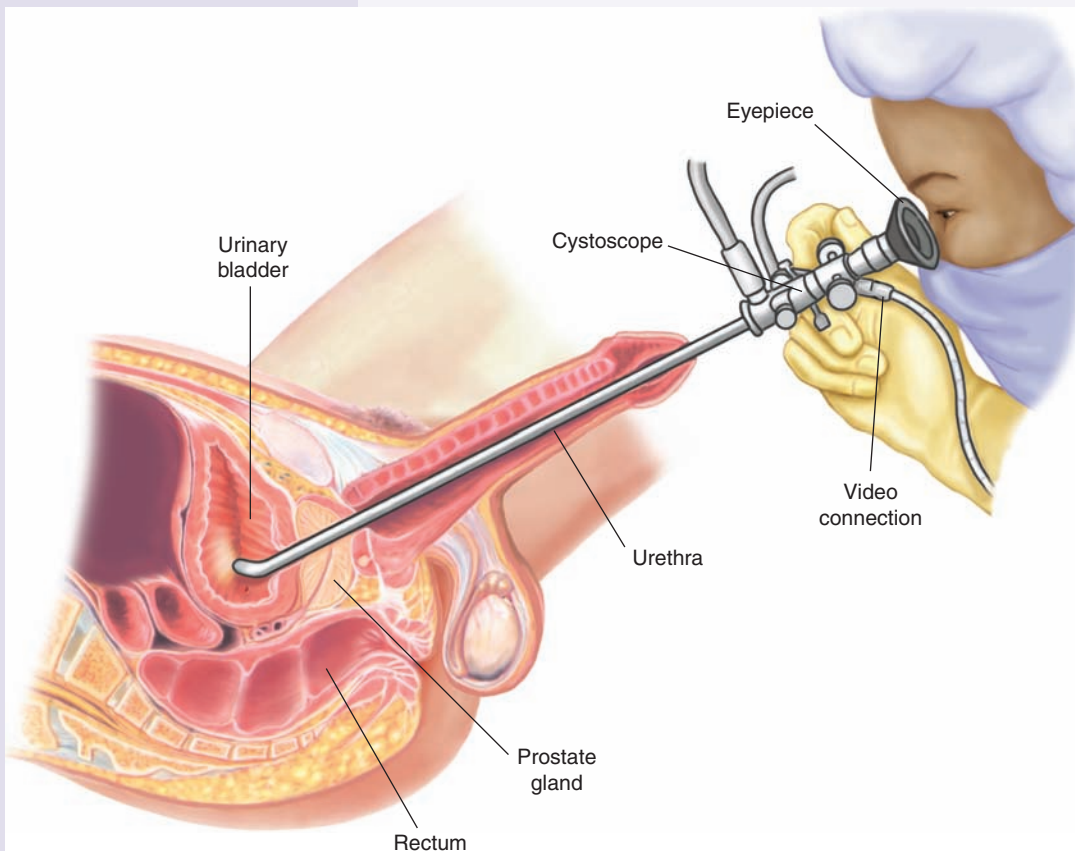
*This section introduces procedures used to diagnose and treat genitourinary system disorders. Descriptions are provided as well as pronunciations and word analyses for selected terms.*

Procedure	Description
<i>Diagnostic Procedures</i>	
<b>Clinical</b>	
<b>digital rectal examination (DRE)</b>	Screening test that assesses the rectal wall surface for lesions or abnormally firm areas that might indicate cancer  <i>In DRE, the physician inserts a gloved, lubricated finger into the rectum. In males, the physician also evaluates the size and consistency of the prostate. (See Figure 11-7.)</i>

(continued)

### Diagnostic and Therapeutic Procedures—cont'd

Procedure	Description
<b>electromyography (EMG)</b> ē-lĕk-trō-mī-ŌG-ră-fĕ <i>electr/o:</i> electricity <i>my/o:</i> muscle <i>-graphy:</i> process of recording	Measures the contraction of muscles that control urination using electrodes placed in the rectum and urethra <i>EMG determines whether incontinence is due to weak muscles or other causes.</i>
<b>testicular self-examination (TSE)</b>	Self-examination of the testes for abnormal lumps or swellings in the scrotal sac <i>TSE is increasingly recommended by physicians to detect abnormalities, especially cancer, when the disease is easily treatable. Testicular cancer is the number one cancer killer in men ages 20 to 30.</i>
<b>Endoscopic</b>	
<b>cystoscopy (cysto)</b> sĭs-TŌS-kō-pĕ <i>cyst/o:</i> bladder <i>-scopy:</i> examination	Endoscopy of the urinary bladder for evidence of pathology, obtaining biopsies of tumors or other growths, and removal of polyps <i>In cystoscopy, a catheter can be inserted through the hollow channel in the cystoscope to collect tissue samples or introduce contrast media during radiography. (See Figure 11-11.)</i>



**Figure 11-11.** Cystoscopy.

## Diagnostic and Therapeutic Procedures—cont'd

Procedure	Description
<b>nephroscopy</b> nĕ-FRŌS-kō-pĕ <i>nephro/o</i> : kidney <i>-scopy</i> : examination	Endoscopy of the kidney(s) using a specialized, three-channel endoscope that enables visualization and irrigation of the kidney <i>The nephroscope is passed through a small incision made in the renal pelvis. Kidney pathology and congenital deformities may be observed.</i>
<b>urethroscopy</b> ū-rĕ-THRŌS-kō-pĕ <i>urethro/o</i> : urethra <i>scopy</i> : examination	Endoscopy of the urethra using a specialized endoscope, typically for lithotripsy or TURP
<b>Laboratory</b>	
<b>blood urea nitrogen (BUN)</b> ū-RE-ă NĪ-trō-jĕn	Test that determines the amount of urea nitrogen, a waste product of protein metabolism, present in a blood sample <i>Because urea is cleared from the bloodstream by the kidneys, the BUN test is used as an indicator of kidney function.</i>
<b>culture and sensitivity (C&amp;S)</b> KŪL-tūr, sĕn-sĭ-TĪ-vĭ-tĕ	Test that determines the causative organism of a disease and how the organism responds to various antibiotics <i>C&amp;S tests are performed on urine, blood, and body secretions.</i>
<b>prostate-specific antigen (PSA)</b> PRŌS-tăt spĕ-SĪF-ĭk ĀN-tĭ-jĕn	Blood test used to detect prostatic disorders, especially prostatic cancer <i>PSA is a substance produced by the prostate and is normally found in a blood sample in small quantities. The level is elevated in prostatitis, benign prostatic hyperplasia, and tumors of the prostate.</i>
<b>semen analysis</b> SĒ-mĕn ă-NĀL-ĭ-sĭs	Test that analyzes a semen sample for volume, sperm count, motility, and morphology to evaluate fertility or verify sterilization after a vasectomy
<b>urinalysis (UA)</b> ū-rĭ-NĀL-ĭ-sĭs	Battery of tests performed on a urine specimen, including physical observation, chemical tests, and microscopic evaluation <i>UA not only provides information on the urinary structures but may also be the first indicator of such system disorders as diabetes and liver and gallbladder disease.</i>
<b>Radiographic</b>	
<b>computed tomography (CT)</b> kŏm-PŪ-tĕd tŏ-MŌG-ră-fĕ <i>tom/o</i> : to cut <i>-graphy</i> : process of recording	Imaging technique that rotates an x-ray emitter around the area to be scanned and measures the intensity of transmitted rays from different angles <i>In the genitourinary system, CTs are used to diagnose tumors, cysts, inflammation, abscesses, perforation, bleeding, and obstructions of the kidneys, ureters, and bladder.)</i>
<b>cystography</b> sĭs-TŌG-ră-fĕ <i>cyst/o</i> : bladder <i>-graphy</i> : process of recording	Radiographic examination of the urinary bladder using a contrast medium <i>Cystography is used to diagnose tumors or defects in the bladder wall, vesicoureteral reflux, stones, or other pathological conditions of the bladder.</i>

(continued)

## Diagnostic and Therapeutic Procedures—cont'd

Procedure	Description
<b>cystometrography</b> sīs-tō-mě-TRÖG-ră-fē <i>cyst/o</i> : bladder <i>metr/o</i> : uterus (womb); measure <i>-graphy</i> : process of recording	Procedure that assesses volume and pressure in the bladder at various stages of filling using saline and a contrast medium introduced into the bladder through a catheter  <i>Cystometrography is the primary test used to investigate stress incontinence and urge incontinence.</i>
<b>intravenous pyelography (IVP)</b> ĩn-tră-VĒ-nūs pī-ě-LÖG-ră-fē <i>intra-</i> : in, within <i>ven</i> : vein <i>-ous</i> : pertaining to <i>pyel/o</i> : renal pelvis <i>-graphy</i> : process of recording	Radiographic examination of the kidneys, and urinary tract after IV injection of a contrast medium; also called <i>excretory urography (EU)</i>  <i>IVP detects kidney stones, enlarged prostate, internal injuries after an accident or trauma, and tumors in the kidneys, ureters, and bladder.</i>
<b>kidney, ureter, bladder (KUB) radiography</b> <i>radi/o</i> : radiation, x-ray; radius (lower arm bone on thumb side) <i>-graphy</i> : process of recording	Radiographic examination to determine the location, size, and shape of the kidneys in relationship to other organs in the abdominopelvic cavity and to identify abnormalities of the urinary system  <i>KUB radiography identifies stones and calcified areas and does not require a contrast medium.</i>
<b>nuclear scan</b>  renal <i>ren</i> : kidney <i>-al</i> : pertaining to,	Radiology test in which radioactive materials called <i>tracers</i> are introduced into the patient and a specialized camera, which acts as a radiation detector, produces images by recording the emitted tracers  Imaging test where a monitor is used to track a radioactive substance as it passes through the kidney
<b>ultrasound (US)</b> ŨL-tră-sownd  scrotal SKRÖ-tāl	Radiograph that uses high-frequency sound waves (ultrasound) and displays the reflected echoes on a monitor; also called <i>sonography</i> , <i>echography</i> , or <i>echo</i>  US used to assess scrotal structures and patency of the vas deferens
<b>voiding cystourethrography (VCUG)</b> sīs-tō-ũ-rē-THRÖG-ră-fē <i>cyst/o</i> : bladder <i>urethr/o</i> : urethra <i>-graphy</i> : process of recording	Radiological examination of the bladder and urethra performed before, during, and after voiding using a contrast medium to enhance imaging  <i>VCUG is performed to determine the cause of repeated bladder infections or stress incontinence and to identify congenital or acquired structural abnormalities of the bladder and urethra.</i>
<b>Therapeutic Procedures</b>	
<b>Clinical</b>	
<b>dialysis</b> dī-ĀL-ĩ-sīs <i>dia-</i> : through, across <i>-lysis</i> : separation; destruction; loosening	Medical procedure used to filter toxic substances from the patient's bloodstream, such as excess electrolytes and nitrogenous wastes  <i>Dialysis provides a means of removing waste products from the blood when kidneys no longer function. Nitrogenous waste products are collected in a solution called dialysate, which is discarded at the end of the procedure. There are two primary methods of dialysis: hemodialysis and peritoneal dialysis.</i>

## Diagnostic and Therapeutic Procedures—cont'd

### Procedure

hemodialysis

hē-mō-dī-ĀL-ī-sīs

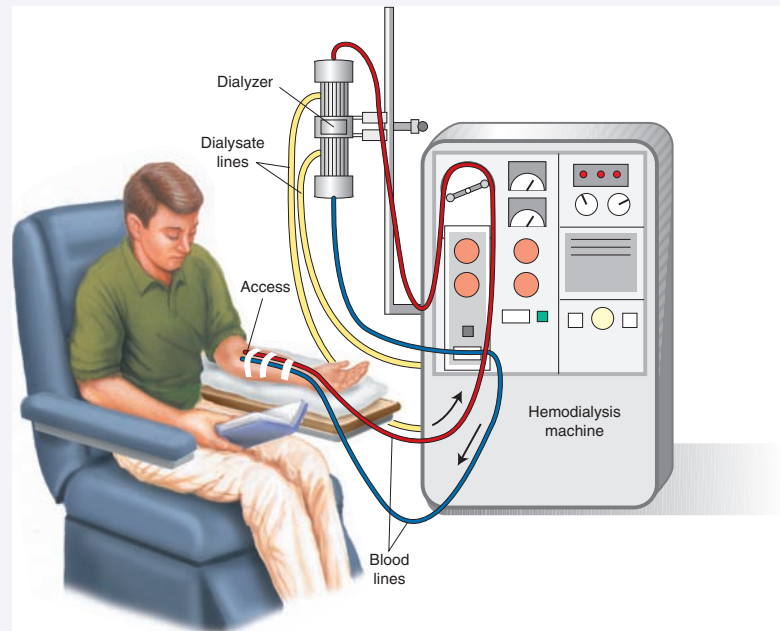
*hem/o*: blood

*dia*: through, across

*-lysis*: separation; destruction;  
loosening

### Description

Method of removing waste substances from the blood by shunting it from the body, passing it through an artificial kidney machine where it is filtered, and then returning the dialyzed blood to the patient's body (See Figure 11-12.)



**Figure 11-12.** Hemodialysis

peritoneal

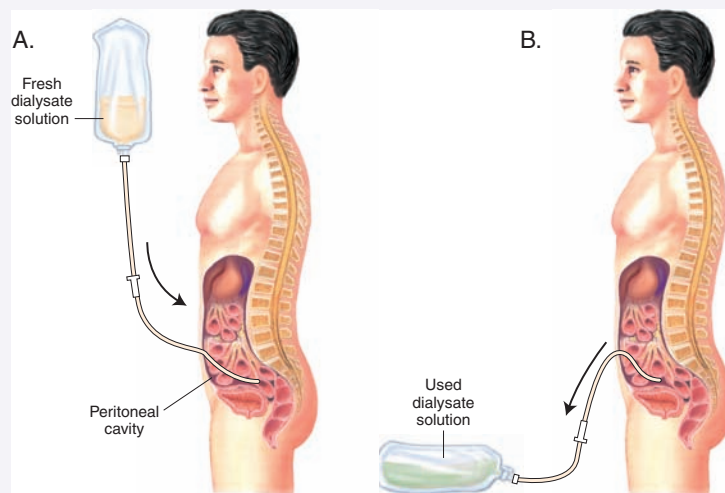
pēr-ī-tō-NĒ-āl

*peritone*: peritoneum

*-al*: pertaining to

Removal of toxic substances from the body by perfusing the peritoneal cavity with a warm, sterile chemical solution (See Figure 11-13.)

*In peritoneal dialysis, the lining of the peritoneal cavity is used as the dialyzing membrane. Dialyzing fluid remains in the peritoneal cavity for 1 to 2 hours and then is removed. The procedure is repeated as often as necessary.*



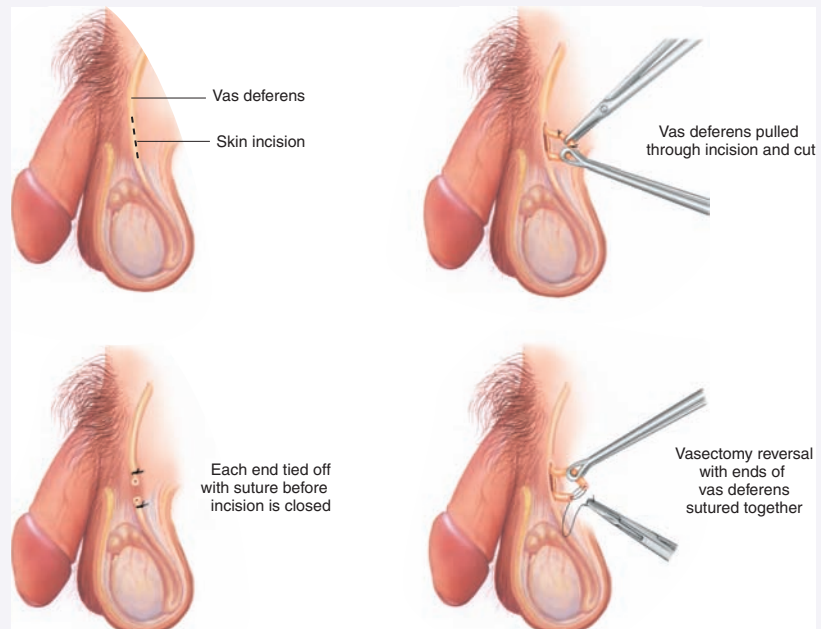
**Figure 11-13.** Peritoneal dialysis. (A) Introducing dialysis fluid into the peritoneal cavity. (B) Draining dialysate with waste products from the peritoneal cavity.

(continued)



## Diagnostic and Therapeutic Procedures—cont'd

Procedure	Description
<b>Surgical</b>	
<b>circumcision</b> sēr-kūm-SĪ-zhūn	Removal of all or part of the foreskin, or <i>prepuce</i> , of the penis
<b>nephropexy</b> NĒF-rō-pĕks-ē <i>nephr/o</i> : kidney <i>-pexy</i> : fixation (of an organ)	Fixation of a floating or mobile kidney
<b>orchidectomy</b> or-kī-DĒK-tō-mē <i>orchid</i> : testis (plural, testes) <i>-ectomy</i> : excision, removal	Removal of one or both testes; also called <i>orchiectomy</i>  <i>Orchidectomy may be indicated for serious disease or injury to the testis or to control cancer of the prostate by removing a source of androgenic hormones.</i>
<b>transurethral resection of the prostate (TURP)</b> trāns-ū-RĒ-thrāl rē-SĔK-shūn PRŌS-tāt <i>trans</i> : across, through <i>urethr/o</i> : urethra <i>-al</i> : pertaining to	Surgical procedure that involves inserting a resectoscope into the urethra to “chip away” at the prostate gland to remove the obstruction and flushing out the chips and sending them for analysis to detect possible evidence of cancer  <i>TURP is used most commonly to relieve obstruction caused by benign prostatic hyperplasia. Because the prostate gland is not completely removed, remaining tissue eventually grows back and may cause obstruction again at a later time.</i>
<b>urethrotomy</b> ū-rē-THRŌT-ō-mē <i>urethr/o</i> : urethra <i>-tomy</i> : incision	Incision of a urethral stricture  <i>Urethrotomy corrects constrictions of the urethra that make voiding difficult.</i>
<b>vasectomy</b> vās-ĒK-tō-mē <i>vas</i> : vessel; vas deferens; duct <i>-ectomy</i> : excision, removal	Excision of all or a segment of the vas deferens (See Figure 11–14.)  <i>Bilateral vasectomy is the most successful method of male contraception. Although the procedure is considered permanent, with advances in microsurgery, vasectomy is sometimes reversible.</i>



**Figure 11-14.** Vasectomy and reversal.

## Pharmacology

Pharmacological agents used to treat urinary tract disorders include antibiotics, diuretics, antidiuretics, urinary antispasmodics, and potassium supplements, which are commonly taken concur-

rently with many diuretics to counteract potassium depletion. (See Table 11–1.) Pharmacologic agents are used to treat conditions of the male reproductive system including hypogonadism, erectile dysfunction, and reproductive concerns and disorders.

**Table 11-1 Drugs Used to Treat Genitourinary Disorders**

This table lists common drug classifications used to treat urinary and male reproductive disorders, their therapeutic actions, and selected generic and trade names.		
Classification	Therapeutic Action	Generic and Trade Names
<b>Urinary System</b>		
<b>antibiotics</b>	Treat bacterial infections of the urinary tract by acting on the bacterial membrane or one of its metabolic processes.  <i>The type of antibiotic prescribed depends on the infecting organism and the type and extent of infection.</i>	<b>ciprofloxacin</b> sĭp-rō-FLŌX-ă-sĭn Cipro  <b>sulfamethoxazole/trimethoprim</b> sŭl-fă-mĕth-ŌX-ă-zŏl trĭ-MĒTH-ŏ-prĭm Bactrim
<b>antispasmodics</b>	Decrease spasms in the urethra and bladder by relaxing the smooth muscles lining their walls, thus allowing normal emptying of the bladder.  <i>Bladder spasms can result from such conditions as urinary tract infections and catheterization.</i>	<b>oxybutynin</b> ŏk-sĕ-BŪ-tĭ-nĭn Ditropan
<b>diuretics</b>	Promote and increase the excretion of urine.  <i>Diuretics are grouped by their action and are used to treat edema, hypertension, heart failure, and various renal and hepatic diseases.</i>	<b>furosemide</b> fŭ-RŌ-sĕ-mĭd Lasix  <b>spironolactone</b> spĭ-rō-nŏ-LĀK-tŏn Aldactone
<b>potassium supplements</b>	Replace potassium due to depletion caused by diuretics.  <i>Dietary sources of potassium are usually not sufficient to replace potassium loss caused by diuretics.</i>	<b>potassium chloride</b> pŏ-TĀS-ĕ-ŭm KLŌ-rĭd K-Tab, Kaon Cl
<b>Male Reproductive System</b>		
<b>androgens</b>	Increase testosterone levels.  <i>Androgens are used to correct hormone deficiency in hypogonadism and treat delayed puberty in males.</i>	<b>testosterone base</b> tĕs-TŌS-tĕr-ŏn Androderm, Testim  <b>testosterone cypionate</b> tĕs-TŌS-tĕr-ŏn SĪP-ĕ-ŏ-năt Depo-testosterone

Table 11-1 Drugs Used to Treat Genitourinary Disorders—cont'd			
Classification	Therapeutic Action	Generic and Trade Names	
anti-impotence agents	Treat erectile dysfunction (impotence) by increasing blood flow to the penis, resulting in an erection.  <i>Anti-impotence drugs should not be used by patients with coronary artery disease or hypertension.</i>	<b>sildenafil citrate</b> sīl-DĚN-ă-fil SĪT-răt Viagra	<b>ildenafil citrate</b> sīl-DĚN-ă-fil SĪT-răt Viagra  <b>ildenafil citrate</b> văr-DĚN-ă-fil Levitra

## Abbreviations

*This section introduces genitourinary-related abbreviations and their meanings.*

Abbreviation	Meaning	Abbreviation	Meaning
AGN	acute glomerulonephritis	ESRD	end-stage renal disease
ARF	acute renal failure	ESWL	extracorporeal shock-wave lithotripsy
ATN	acute tubular necrosis	EU	excretory urography
BNO	bladder neck obstruction	GU	genitourinary
BPH	benign prostatic hyperplasia; benign prostatic hypertrophy	HD	hemodialysis; hip disarticulation; hearing distance
BUN	blood urea nitrogen	HTN	hypertension
C&S	culture and sensitivity	IVP	intravenous pyelogram, intravenous pyelography
Cath	catheterization; catheter	K	potassium (an electrolyte)
CT	computed tomography	KUB	kidney, ureter, bladder
cysto	cystoscopy	Na	sodium (an electrolyte)
DRE	digital rectal examination	PCNL	percutaneous nephrolithotomy
EBT	external beam therapy	pH	symbol for degree of acidity or alkalinity
ED	erectile dysfunction; emergency department	PKD	polycystic kidney disease
EMG	electromyogram, electromyography	PSA	prostate-specific antigen

<b>Abbreviations</b>			
<b>Abbreviation</b>	<b>Meaning</b>	<b>Abbreviation</b>	<b>Meaning</b>
<b>RP</b>	retrograde pyelogram, retrograde pyelography	<b>UA</b>	urinalysis
<b>sp. gr.</b>	specific gravity	<b>UTI</b>	urinary tract infection
<b>TSE</b>	testicular self-examination	<b>VCUG</b>	voiding cystourethrography prostate
<b>TURP</b>	transurethral resection of the	<b>VUR</b>	vesicoureteral reflux



*It is time to review procedures, pharmacology, and abbreviations by completing Learning Activity 11-5.*

## LEARNING ACTIVITIES

The activities that follow provide review of the genitourinary system terms introduced in this chapter. Complete each activity and review your answers to evaluate your understanding of the chapter.

### Learning Activity 11-1

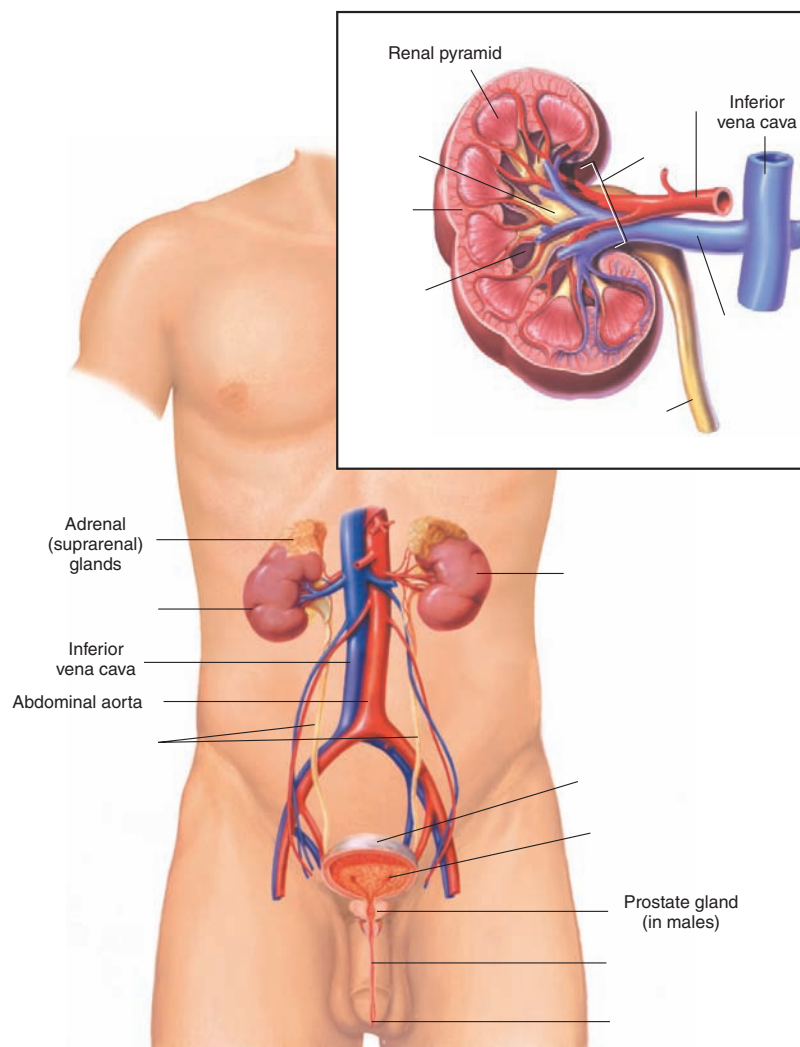
### Identifying Urinary Structures

Label the following illustration using the terms listed below.

hilum      renal cortex      renal vein      urethra      urinary meatus

left kidney      renal medulla      right kidney      ureteral orifice

renal artery      renal pelvis      ureters      urinary bladder



Check your answers by referring to Figure 11-1 on page 311. Review material that you did not answer correctly.

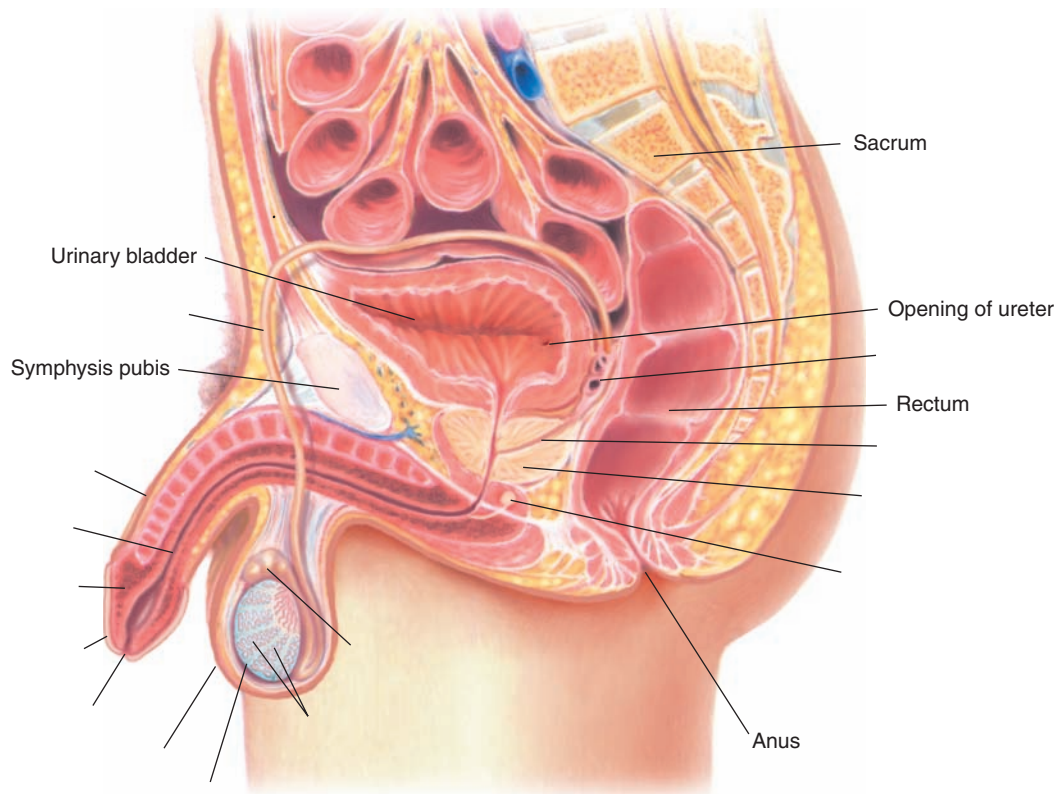


## Learning Activity 11-2

## Identifying Male Reproductive Structures

Label the following illustration using the terms listed below.

<i>bulbourethral gland</i>	<i>prepuce</i>	<i>testis</i>
<i>ejaculatory duct</i>	<i>prostate gland</i>	<i>urethra</i>
<i>epididymis</i>	<i>scrotum</i>	<i>urethral orifice</i>
<i>glans penis</i>	<i>seminal vesicle</i>	<i>vas deferens</i>
<i>penis</i>	<i>seminiferous tubules</i>	



Check your answers by referring to Figure 11-3 on page 314. Review material that you did not answer correctly.



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Enhance your study and reinforcement of word elements with the power of DavisPlus. Visit [www.davisplus.fadavis.com/glyls/systems](http://www.davisplus.fadavis.com/glyls/systems) for this chapter's flash-card activity. We recommend you complete the flash-card activity before completing Activity 11-3 below.

## Learning Activity 11-3

**Building Medical Words**

---

Use *nephr/o* (kidney) to build words that mean:

1. stone in the kidney \_\_\_\_\_
2. abnormal condition of pus in the kidney \_\_\_\_\_
3. abnormal condition of water in the kidney \_\_\_\_\_

Use *pyel/o* (renal pelvis) to build words that mean:

4. dilation of renal pelvis \_\_\_\_\_
5. disease of renal pelvis \_\_\_\_\_

Use *ureter/o* (ureter) to build words that mean:

6. dilation of ureter \_\_\_\_\_
7. calculus in ureter \_\_\_\_\_

Use *cyst/o* (bladder) to build words that mean:

8. inflammation of bladder \_\_\_\_\_
9. instrument to view the bladder \_\_\_\_\_

Use *vesic/o* (bladder) to build words that mean:

10. herniation of bladder \_\_\_\_\_
11. pertaining to bladder and prostate \_\_\_\_\_

Use *urethr/o* (urethra) to build words that mean:

12. narrowing or stricture of urethra \_\_\_\_\_
13. instrument used to incise urethra \_\_\_\_\_

Use *ur/o* (urine, urinary tract) to build words that mean:

14. radiography of urinary tract \_\_\_\_\_
15. disease of urinary tract \_\_\_\_\_

Use the suffix *-uria* (urine) to build words that mean:

16. difficult or painful urination \_\_\_\_\_
17. scanty urination \_\_\_\_\_

Use *orchid/o* or *orchi/o* (testes) to build words that mean:

18. disease of testes \_\_\_\_\_
19. pain in testes \_\_\_\_\_

Use *balan/o* (glans penis) to build a word that means:

20. discharge from glans penis \_\_\_\_\_

Build surgical words that mean:

21. excision of testes \_\_\_\_\_

22. surgical repair of glans penis \_\_\_\_\_

23. excision of vas deferens \_\_\_\_\_

24. incision of renal pelvis \_\_\_\_\_

25. fixation of bladder \_\_\_\_\_



*Check your answers in Appendix A. Review material that you did not answer correctly.*

**Correct Answers** \_\_\_\_\_  $\times 4 =$  \_\_\_\_\_ % Score

## Learning Activity 11-4

## Matching Pathological, Diagnostic, Symptomatic, and Related Terms

Match the following terms with the definitions in the numbered list.

<i>anorchidism</i>	<i>benign prostatic hyperplasia</i>	<i>hesitancy</i>	<i>oliguria</i>
<i>anuria</i>	<i>enuresis</i>	<i>hydrocele</i>	<i>phimosis</i>
<i>aspermia</i>	<i>epispadias</i>	<i>hydronephrosis</i>	<i>pyuria</i>
<i>azotemia</i>	<i>fistula</i>	<i>nephrotic syndrome</i>	<i>sterility</i>
<i>balanitis</i>	<i>herniorrhaphy</i>	<i>nocturia</i>	<i>urgency</i>

1. \_\_\_\_\_ need to void immediately
2. \_\_\_\_\_ abnormal passage from a hollow organ to the surface or between organs
3. \_\_\_\_\_ complete absence of one or both testes
4. \_\_\_\_\_ absence of urine production
5. \_\_\_\_\_ nitrogenous wastes in blood
6. \_\_\_\_\_ dilation of kidneys and calices, usually due to reflux
7. \_\_\_\_\_ nonmalignant enlargement of the prostate gland
8. \_\_\_\_\_ difficulty starting urination
9. \_\_\_\_\_ scanty urine production
10. \_\_\_\_\_ loss of large amounts of plasma protein, resulting in systemic edema
11. \_\_\_\_\_ stenosis of the preputial orifice
12. \_\_\_\_\_ inability to produce offspring
13. \_\_\_\_\_ malformation in which the urethra opens on the dorsum of the penis
14. \_\_\_\_\_ lack of or failure to ejaculate semen
15. \_\_\_\_\_ pus in urine
16. \_\_\_\_\_ suture of a hernia
17. \_\_\_\_\_ excessive urination at night
18. \_\_\_\_\_ involuntary passage of urine
19. \_\_\_\_\_ accumulation of fluid in a saclike cavity
20. \_\_\_\_\_ inflammation of skin covering the penis



Check your answers in Appendix A. Review any material that you did not answer correctly.

**Correct Answers** \_\_\_\_\_ × 5 = \_\_\_\_\_ % Score

## Learning Activity 11-5

## Matching Procedures, Pharmacology, and Abbreviations

Match the following terms with the definitions in the numbered list.

*androgens*      *diuretics*      *potassium supplements*

*antibiotics*      *ESWL*      *PSA*

*C&S*      *KUB*      *semen analysis*

*circumcision*      *orchidectomy*      *urethrotomy*

*cystoscopy*      *peritoneal dialysis*      *vasectomy*

1. \_\_\_\_\_ radiograph that shows the size, shape, and location of the kidneys
2. \_\_\_\_\_ test used to verify sterility after vasectomy
3. \_\_\_\_\_ visual examination of the urinary bladder
4. \_\_\_\_\_ inhibit or kill bacterial microorganisms
5. \_\_\_\_\_ laboratory test that evaluates effect of an antibiotic on an organism
6. \_\_\_\_\_ drugs used to promote the excretion of urine
7. \_\_\_\_\_ incision of a urethral stricture
8. \_\_\_\_\_ noninvasive test used to pulverize urinary or bile stones
9. \_\_\_\_\_ removal of toxic substances by perfusing the peritoneal cavity
10. \_\_\_\_\_ blood test to detect prostatic disorders, especially cancer
11. \_\_\_\_\_ most effective form of male contraception
12. \_\_\_\_\_ surgical removal of the testes
13. \_\_\_\_\_ surgical removal of all or part of the foreskin
14. \_\_\_\_\_ used to increase testosterone levels
15. \_\_\_\_\_ used to treat or prevent the hypokalemia commonly associated with the use of diuretics



*Check your answers in Appendix A. Review material that you did not answer correctly.*

**Correct Answers** \_\_\_\_\_  $\times 6.67 =$  \_\_\_\_\_ % Score



## MEDICAL RECORD ACTIVITIES

The two medical records included in the following activities use common clinical scenarios to show how medical terminology is used to document patient care. Complete the terminology and analysis sections for each activity to help you recognize and understand terms related to the genitourinary system.

### Medical Record Activity 11-1

#### Operative Report: Ureterocele and Ureterocele Calculus

#### Terminology

Terms listed in the following table are taken from *Operative report: Ureterocele and ureterocele calculus* that follows. Use a medical dictionary such as *Taber's Cyclopedic Medical Dictionary*, the appendices of this book, or other resources to define each term. Then review the pronunciations for each term and practice by reading the medical record aloud.

Term	Definition
calculus KĀL-kū-lūs	
cystolithotripsy sīs-tō-LĪTH-ō-trīp-sē	
cystoscope SĪST-ō-skōp	
fulguration fūl-gū-RĀ-shūn	
hematuria hē-mă-TŪ-rē-ă	
resectoscope rē-SĒK-tō-skōp	
transurethral trāns-ū-RĒ-thrāl	
ureterocele ū-RĒ-tēr-ō-sēl	
urethral sound ū-RĒ-thrāl	



Listen and Learn Online! *will help you master the pronunciation of selected medical words from this medical record activity. Visit [www.davisplus.com/gyls/systems](http://www.davisplus.com/gyls/systems) to find instructions on completing the Listen and Learn Online! exercise for this section and to practice pronunciations.*

## OPERATIVE REPORT: URETEROCELE AND URETEROCELE CALCULUS

General Hospital

1511 Ninth Avenue ■■ Sun City, USA 12345 ■■ (555) 802-1887

### OPERATIVE REPORT

Date: May 14, 20xx  
Patient: Motch, Edwin

Physician: Elmer Augustino, MD  
Patient: ID#: 48778

**PREOPERATIVE DIAGNOSIS:** Hematuria with left ureterocele and ureterocele calculus.

**POSTOPERATIVE DIAGNOSIS:** Hematuria with left ureterocele and ureterocele calculus.

**OPERATION:** Cystoscopy, transurethral incision of ureterocele, extraction of stone, and cystolithotripsy.

**ANESTHESIA:** General.

**COMPLICATIONS:** None.

**PROCEDURE:** Patient was prepped and draped and placed in the lithotomy position. The urethra was calibrated with ease using a #26 French Van Buren urethral sound. A #24 resectoscope was inserted with ease. The prostate and bladder appeared normal, except for the presence of a left ureterocele, which was incised longitudinally; a large calculus was extracted from the ureterocele. There was minimal bleeding and no need for fulguration. The stone was crushed with the Storz stone-crushing instrument, and the fragments were evacuated. The bladder was emptied and the procedure terminated.

Patient tolerated the procedure well and was transferred to the postanesthesia care unit.

*Elmer Augustino, MD*  
Elmer Augustino, MD

ea:bg

D: 5-14-20xx  
T: 5-14-20xx

## Analysis

Review the medical record *Operative Report: Ureterocele and Ureterocele Calculus* to answer the following questions.

1. What were the findings from the resectoscopy?

---

2. What was the name and size of the urethral sound used in the procedure?

---

3. What is the function of the urethral sound?

---

4. In what direction was the ureterocele incised?

---

5. Was fulguration required? Why or why not?

---

### Medical Record Activity 11-2

## Operative Report: Extracorporeal Shock-Wave Lithotripsy

### Terminology

Terms listed in the following table are taken from the *Operative Report: Extracorporeal Shock-Wave Lithotripsy* that follows. Use a medical dictionary such as *Taber's Cyclopedic Medical Dictionary*, the appendices of this book, or other resources to define each term. Then review the pronunciations for each term and practice by reading the medical record aloud.

Term	Definition
calculus KĀL-kū-lūs	
calyx KĀ-līx	
cystoscope SĪST-ō-skōp	
cystoscopy sīs-TŌS-kō-pē	
dorsal lithotomy DOR-sāl lith-ŌT-ō-mē	
ESWL	
extracorporeal ēks-trā-kor-POR-ē-āl	
fluoroscopy floo-or-ŌS-kō-pē	

Term	Definition
lithotripsy LĪTH-ō-trīp-sē	
Lt	
shock-wave	
staghorn calculus STĀG-horn KĀL-kū-lūs	
stent stĕnt	



Listen and Learn Online! *will help you master the pronunciation of selected medical words from this medical record activity. Visit [www.davisplus.com/gyls/systems](http://www.davisplus.com/gyls/systems) to find instructions on completing the Listen and Learn Online! exercise for this section and to practice pronunciations.*

## OPERATIVE REPORT: EXTRACORPOREAL SHOCK-WAVE LITHOTRIPSY

General Hospital

1511 Ninth Avenue ■■ Sun City, USA 12345 ■■ (555) 802-1887

### OPERATIVE REPORT

Date: April 1, 20xx  
Patient: Marino, Julius

Physician: Elmer Augustino, MD  
Room: 7201

**PREOPERATIVE DIAGNOSIS:** Left renal calculus.

**POSTOPERATIVE DIAGNOSIS:** Left renal calculus.

**PROCEDURE:** Extracorporeal shock-wave lithotripsy, cystoscopy with double-J stent removal

**INDICATION FOR PROCEDURE:** This 69-year-old male had undergone ESWL on 5/15/xx, with double-J stent placement to allow stone fragments to pass from the calyx to the bladder. At that time, approximately 50% of a partial staghorn calculus was fragmented. He now presents for the fragmenting of the remainder of the calculus and removal of the double-J stent.

**ANESTHESIA:** General.

**COMPLICATIONS:** None.

**OPERATIVE TECHNIQUE:** Patient was brought to the Lithotripsy Unit and placed in the supine position on the lithotripsy table. After induction of anesthesia, fluoroscopy was used to position the patient in the focal point of the shock waves. Being well positioned, he was given a total of 4,000 shocks with a maximum power setting of 3.0. After confirming complete fragmentation via fluoroscopy, the patient was transferred to the cystoscopy suite.

Patient was placed in the dorsal lithotomy position and draped and prepped in the usual manner. A cystoscope was inserted into the bladder through the urethra. Once the stent was visualized, it was grasped with the grasping forceps and removed as the scope was withdrawn.

Patient tolerated the procedure well and was transferred to recovery.

*Elmer Augustino, MD*  
Elmer Augustino, MD

ea:bg

D: 5-14-20xx  
T: 5-14-20xx



## Analysis

Review the medical record *Operative Report: Extracorporeal Shock-Wave Lithotripsy* to answer the following questions.

1. What previous procedures were performed on the patient?

---

2. Why is this current procedure being performed?

---

3. What imaging technique was used for positioning the patient to ensure that the shock waves would strike the calculus?

---

4. In what position was the patient placed in the cystoscopy suite?

---

5. How was the double-J stent removed?

---

