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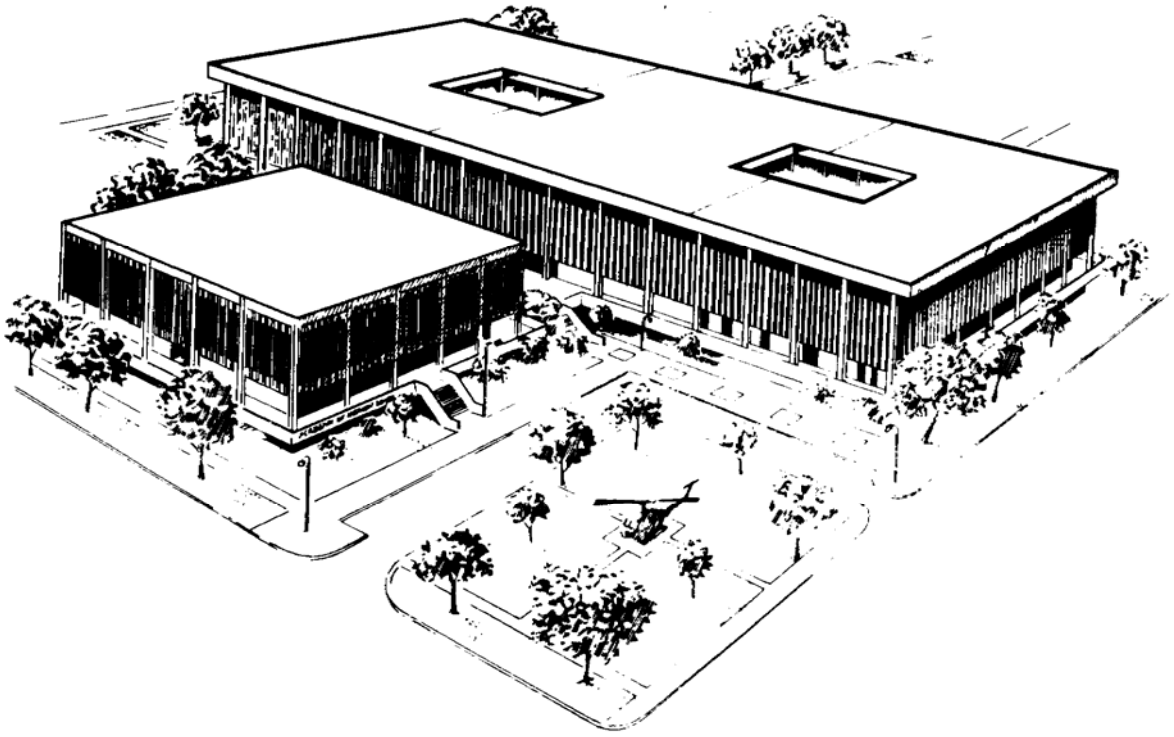

THE GENITOURINARY SYSTEM I

SUBCOURSE MD0579 EDITION 100

DEVELOPMENT

This subcourse is approved for resident and correspondence course instruction. It reflects the current thought of the Academy of Health Sciences and conforms to printed Department of the Army doctrine as closely as currently possible. Development and progress render such doctrine continuously subject to change.

ADMINISTRATION

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CLARIFICATION OF TERMINOLOGY

When used in this publication, words such as "he," "him," "his," and "men" 'are intended to include both the masculine and feminine genders, unless specifically stated otherwise or when obvious in context.

USE OF PROPRIETARY NAMES

The initial letters of the names of some products may be capitalized in this subcourse. Such names are proprietary names, that is, brand names or trademarks. Proprietary names have been used in this subcourse only to make it a more effective learning aid. The use of any name, proprietary or otherwise, should not be interpreted as endorsement, deprecation, or criticism of a product; nor should such use be considered to interpret the validity of proprietary rights in a name, whether it is registered or not.

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CORRESPONDENCE COURSE OF
THE U.S. ARMY MEDICAL DEPARTMENT CENTER AND SCHOOL

SUBCOURSE MD0579

THE GENITOURINARY SYSTEM I

INTRODUCTION

Today, more than 8 million Americans are affected by renal-related diseases. This fact suggests that you will probably deal with renal patients often. Add to this the complex human reproductive system by which a single cell duplicates its genetic material, allowing an organism to grow and repair itself. To give patients with problems in either or both systems the best possible care, you need to know normal anatomy and physiology of the systems, specific disorders in each system, assessment methods, and treatments. Regardless of the cause or the duration of the problem, it is important for you as a combat medical specialist to be able to recognize and treat/refer for treatment any individual with genitourinary system difficulties.

Subcourse Components:

The subcourse instructional material consists of four lessons as follows:

Lesson 1, Anatomy and Physiology of the Genitourinary System.
Lesson 2, Physical Assessment of the Genitourinary System.
Lesson 3, Urinary System Diseases/Disorders.
Lesson 4, Urinary Catheterization.

Here are some suggestions that may be helpful to you in completing this subcourse:

--Read and study each lesson carefully.

--Complete the subcourse lesson by lesson. After completing each lesson, work the exercises at the end of the lesson, marking your answers in this booklet.

--After completing each set of lesson exercises, compare your answers with those on the solution sheet that follows the exercises. If you have answered an exercise incorrectly, check the reference cited after the answer on the solution sheet to determine why your response was not the correct one.

Credit Awarded:

Upon successful completion of the examination for this subcourse, you will be awarded 6 credit hours.

To receive credit hours, you must be officially enrolled and complete an examination furnished by the Nonresident Instruction Branch at Fort Sam Houston, Texas.

You can enroll by going to the web site http://atrrs.army.mil and enrolling under "Self Development" (School Code 555).

A listing of correspondence courses and subcourses available through the Nonresident Instruction Section is found in Chapter 4 of DA Pamphlet 350-59, Army Correspondence Course Program Catalog. The DA PAM is available at the following website: http://www.usapa.army.mil/pdffiles/p350-59.pdf.

LESSON ASSIGNMENT

LESSON 1	Anatomy and Physiology of the Genitourinary System
LESSON ASSIGNMENT	Paragraphs 1-1 through 1-9.
LESSON OBJECTIVES	After completing this lesson, you should be able to:

1-1. Identify the structure, location, and function of the kidneys.

1-2. Identify the structure, location, and function of the kidneys.

1-3. Identify the structure, location, and function of the ureters.

1-4. Identify the structure, location, and function of the bladder.

1-5. Identify the structure, location, and function of the urethra.

1-6. Identify terminology, physiology, and important characteristics of urine.

1-7. Identify internal and external components and functions of the male genitalia.

1-8. Identify characteristics, structures, and functions of the female genital system.

SUGGESTION After completing the assignment, complete the exercises at the end of this lesson. These exercises will help you to achieve the lesson objectives.

LESSON 1

ANATOMY AND PHYSIOLOGY OF THE GENITOURINARY SYSTEM

1-1. INTRODUCTION

The term "genitourinary" actually refers to two different systems. Urinary refers to the system responsible for removal of nitrogenous waste products of metabolism from the bloodstream, disposal of concentrated wastes (urine), and also water conservation. Genito refers to the genital organs and the reproductive system, which is responsible for production of succeeding generations for perpetuation of the species.

1-2. URINARY SYSTEM

The urinary system's primary function is to help keep the body in homeostasis (internal environment of the body remains relatively the same, within limits) by controlling the composition and volume of blood. The urinary system does this by removing and restoring selected amounts of water and solutes. The urinary system is made up of two kidneys, two ureters, one urinary bladder, and one urethra. Each kidney, the primary organs of this system, excretes urine through a ureter. The urine is stored in the urinary bladder and finally expelled from the body through the urethra. See figures 1-1 and 1-2 for organs of the urinary system

NOTE: Other systems also have a part in waste elimination from the body. These systems are the respiratory, integumentary, and digestive systems

1-3. KIDNEYS

The two kidneys are reddish, bean-shaped organs. They are located on the posterior wall of the abdominal cavity between the level of the twelfth thoracic vertebra (T-12) and the third lumbar vertebra (L3). Think of these organs as being just above the waist. The term for their location is retroperitoneal, which means that they are external to the peritoneal lining of the abdominal cavity. These organs are about 11 to 12 centimeters long and 5 to 6 centimeters wide. Since the liver occupies a large space on the right side of the abdominal cavity, the right kidney is slightly lower than the left kidney. The kidneys are held in place by fat. See figure 1-3.

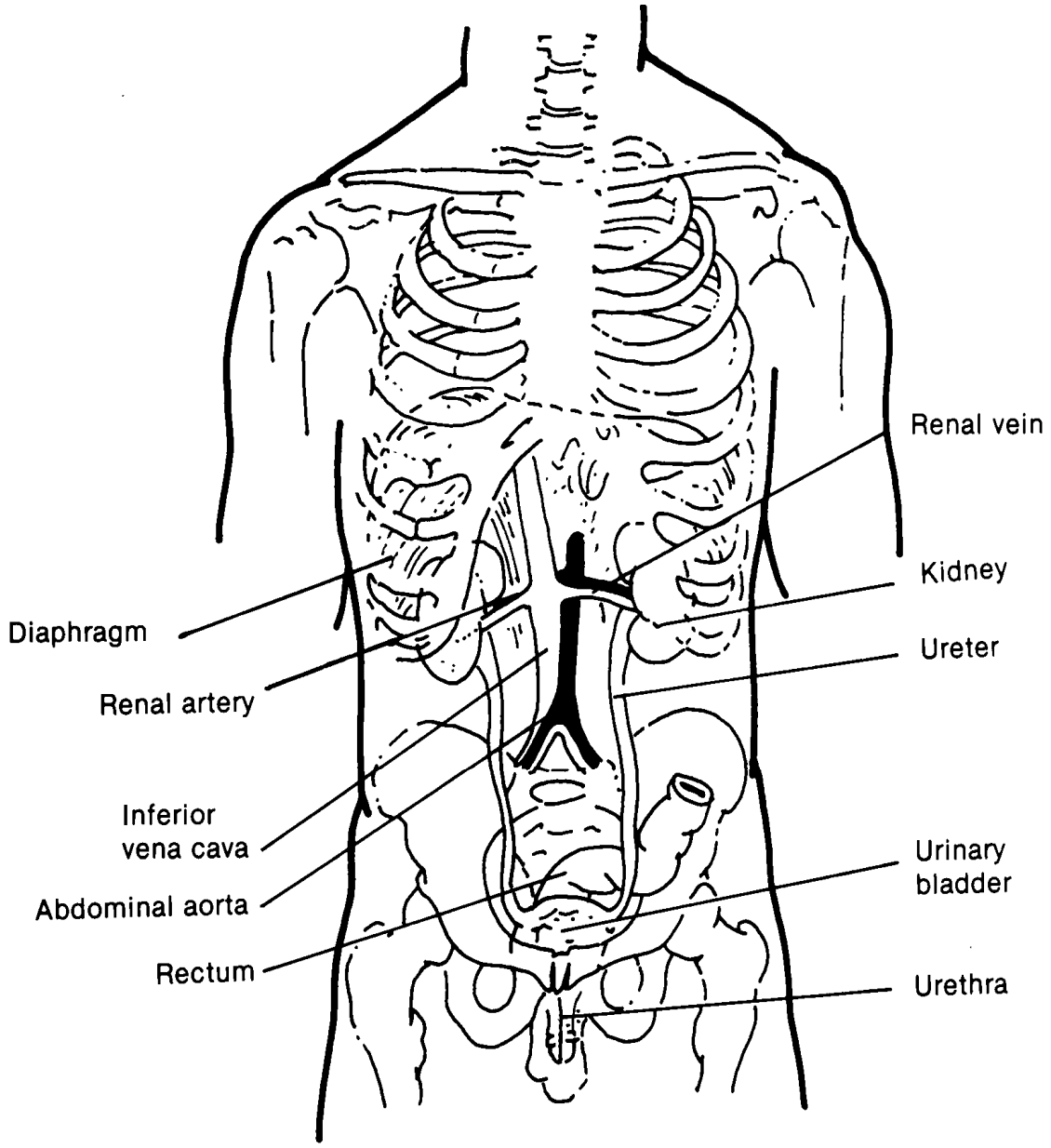

Figure 1-1. Organs of the male urinary system.

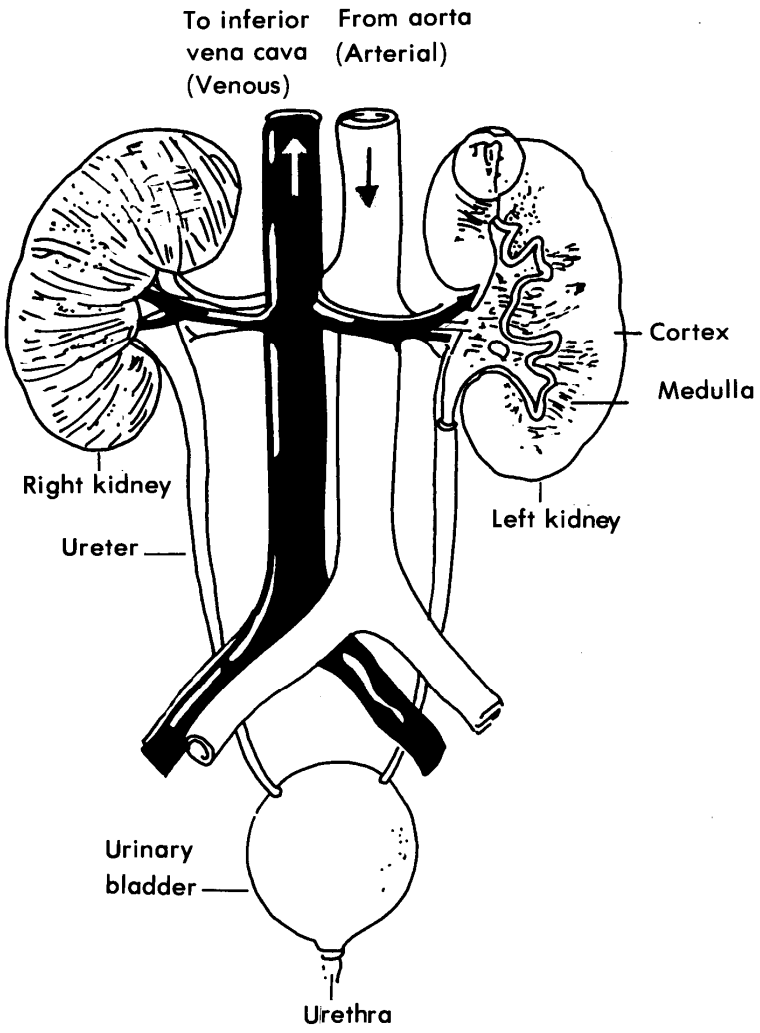

Figure 1-2. Urinary system organs.

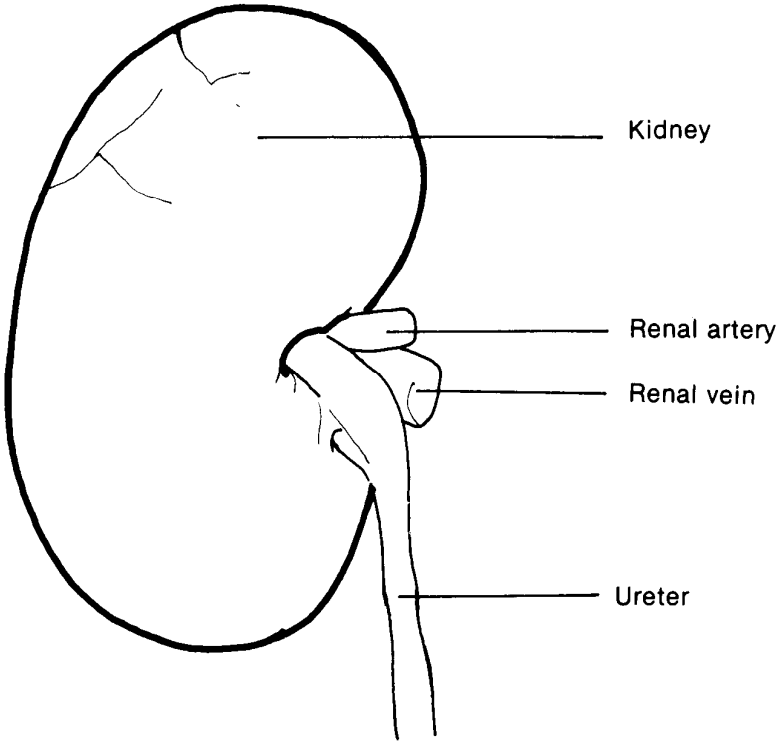

Figure 1-3. External view of the right kidney.

a. **Functions of the Kidneys.** The kidneys accomplish these functions:

(1) Filter metabolic wastes. The kidneys remove wastes from the blood in the form of urine.

(2) Form urine. Urine is formed by the activities of the kidneys.

(3) Balance fluid and electrolytes. The kidneys are the organs that regulate the composition and volume of blood.

(4) Balance acid base.

(5) Influence blood pressure. To aid in regulating blood pressure, the kidneys secrete the enzyme renin.

b. **Kidney Tissue.** The kidneys are composed of three types of tissue: capsule tissue, cortex tissue, and medulla tissue. Capsule tissue is tough, white fibrous connective tissue on the kidney surface. Cortex tissue covers the outer portion of the kidney. Cortex tissue is firm and reddish-brown in color. Medulla tissue makes up the masses of collecting tubes, which are the inner portion of the kidneys. The renal pyramids and papillae are composed of medulla tissue. Cortex tissue extends between the renal pyramids and the conical masses of tubes in the inner part of the kidneys. Cortex tissue forms an outer layer on the kidneys and medulla forms inner kidney renal columns. See figure 1-4.

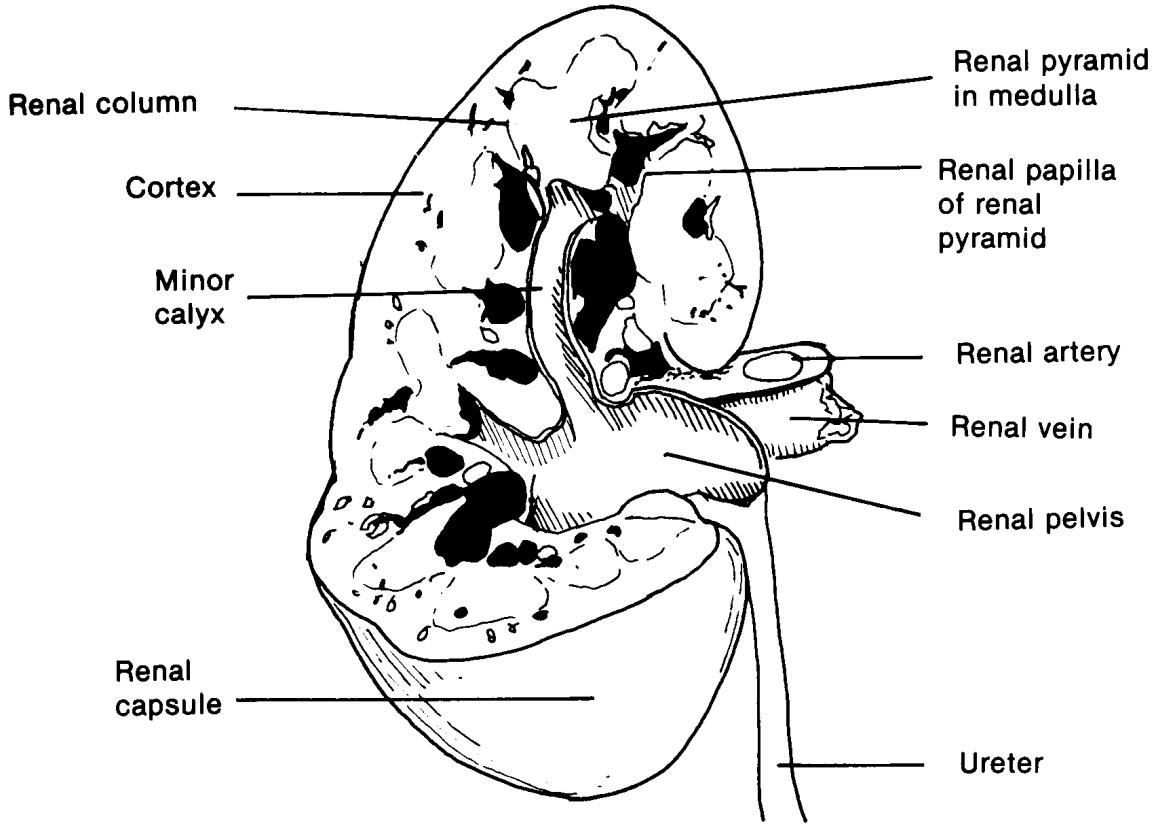

Figure 1-4. Diagram of a cross section of the right kidney.

c. **Hilium.** The hilium is a notch near the center of the rounded border of each kidney. Blood vessels and the ureter enter each kidney at this point.

d. **Renal Pelvis.** The part of the kidney that is the collecting point for urine formed in the kidneys is called the renal pelvis. Peristalsis carries urine from the renal pelvis to the ureter.

e. **Nephron.** The nephron is the functional unit of the kidney. It is estimated that each kidney has about a million nephrons. Each nephron consists of a renal corpuscle and a tubular system. See figure 1-5.

NEPHRON = renal corpuscle + tubular system

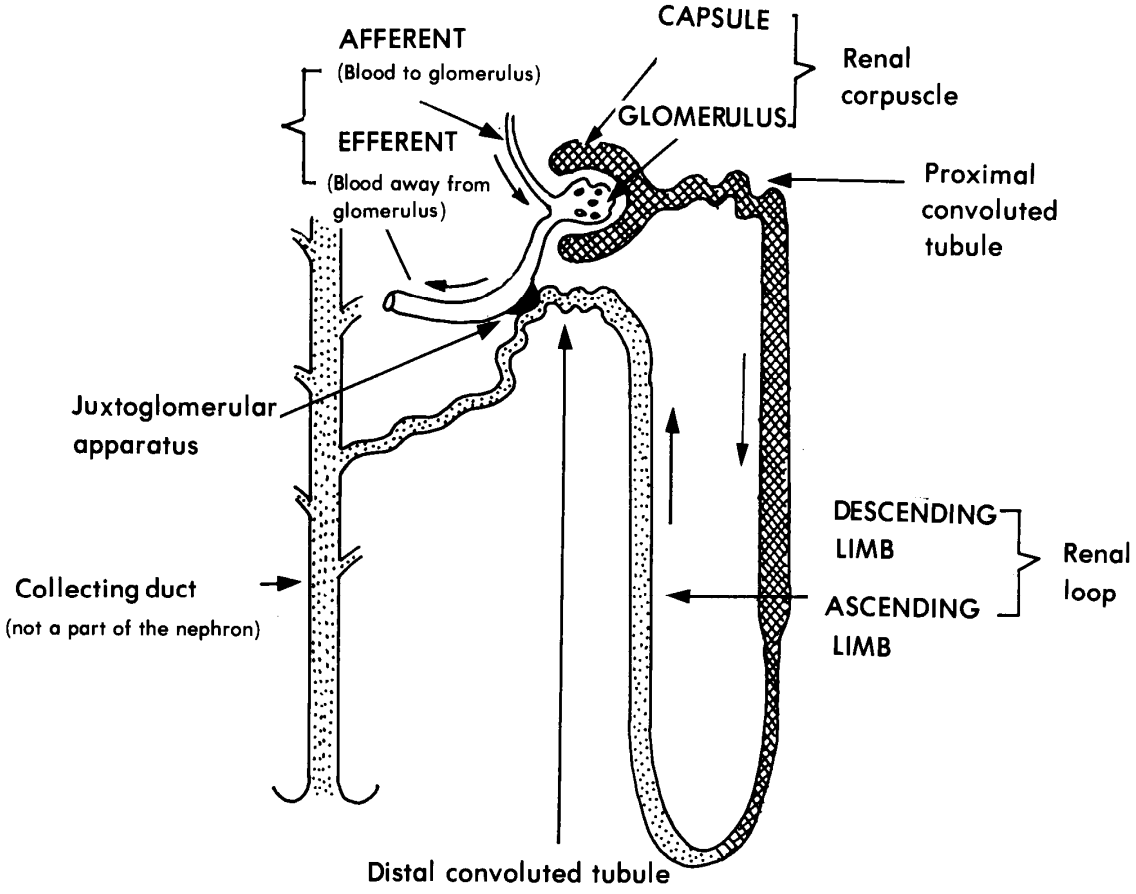

Figure 1-5. A "typical" nephron.

(1) Renal corpuscle.

(a) Structure. The renal corpuscle has a hollow, double-walled sac called the renal capsule (Bowman's capsule). Leading into the capsule is a very small artery called the afferent arteriole. Within the capsule, this artery becomes a mass of capillaries known as the glomerulus. An efferent arteriole drains blood away from the capsule. The capsule and glomerulus together are known as the renal corpuscle.

(b) Function. An afferent arteriole supplies blood to the glomerulus. An efferent arteriole drains blood from the glomerulus. The blood from the afferent arteriole fills the glomerulus. Because of a pressure gradient, a large percentage of fluid in this blood passes through the wall of the glomerular capillary. The fluid then passes through the inner wall of the capsule. This brings the fluid into the hollow space between the inner and outer walls of the renal capsule.

AFFERENT = carry to
EFFERENT = carry away from

(2) Renal tubule.

(a) Structure. Each renal capsule is drained by a renal tubule. This part of the tubular system runs a long distance in a coiled formation and is called the proximal convoluted tubule. A long loop, the renal loop of Henle extends down into the medulla with two straight parts and a sharp bend at the bottom. As the tube returns to the cortex layer, it once again becomes coiled and is known here as the distal convoluted tubule. The distal convoluted tubule is the end of the nephron unit.

(b) Reabsorption. The renal tubule reabsorbs the fluid or filtrate passing through the tubular system, of the nephron. As fluid or filtrate passes through the renal tubule, the majority of the water, glucose, and other valuable substances are removed from the fluid, reabsorbed in the tubule, and returned to the cardiovascular system. Essential electrolytes such as sodium, chloride, and bicarbonate are reabsorbed in the tubules. The hormone aldosterone controls the reabsorption of sodium salts. Aldosterone is a hormone produced in the adrenal gland. Water and nonelectrolytes such as glucose, amino acids, and nutrients are also absorbed by renal tubes.

(c) Secretion. The function of the renal tubule is tubular secretion. Tubular reabsorption removes substances from the filtrate into the blood and also adds materials to the fluid from the blood. Substances secreted by renal tubules include potassium ions, hydrogen ions, ammonia, creatinine, and the drugs penicillin and aminohippuric acid. There are two main effects from tubular secretions. The substances in the secretions help rid the body of certain materials and also help control the blood pH.

(3) Summary.

(a) The major work of the urinary system is done by the nephrons. The other parts of the urinary system are mainly passageways and storage areas. Each nephron is made up of a renal corpuscle and a tubular system. Three important functions are carried out by nephrons.

1 Nephrons control blood concentration and volume by removing selected amounts of water and solutes.

2 Nephrons help regulate blood pH.

3 Nephrons remove toxic wastes from the blood.

(b) As the nephrons go about these activities, they remove many materials from the blood, return the ones that the body requires, and eliminate the remainder. The eliminated materials are collectively called urine. The entire volume of blood in the body is filtered by the kidneys about 60 times a day.

f. **Collecting Tubules.** The distal convoluted tubules of several nephrons empty into a collecting tubule. That is, several tubules join larger tubules of a renal pyramid to form one tubule that opens at a renal papilla and drains into a calyx in the renal pelvis. The final reabsorption of electrolytes, water, and glucose takes place in these collecting tubules. Also, the final secretion of electrolytes and nonelectrolytes takes place here.

1-4. URETERS

A ureter is a tubular structure that is continuous with the renal pelvis. The ureters, one for each kidney, are musculomembranous in structure, 10 to 12 inches long, and form the upper part of the renal pelvis of the kidney. The ureters convey urine from the kidneys to the bladder by the process of peristalsis. Urine moves along the ureters drop by drop, pushed by the wave-like muscular contractions of peristalsis of the tubular wall. From the renal pelvis, the urine drains into the ureters, entering the urinary bladder at its base. See figure 1-6.

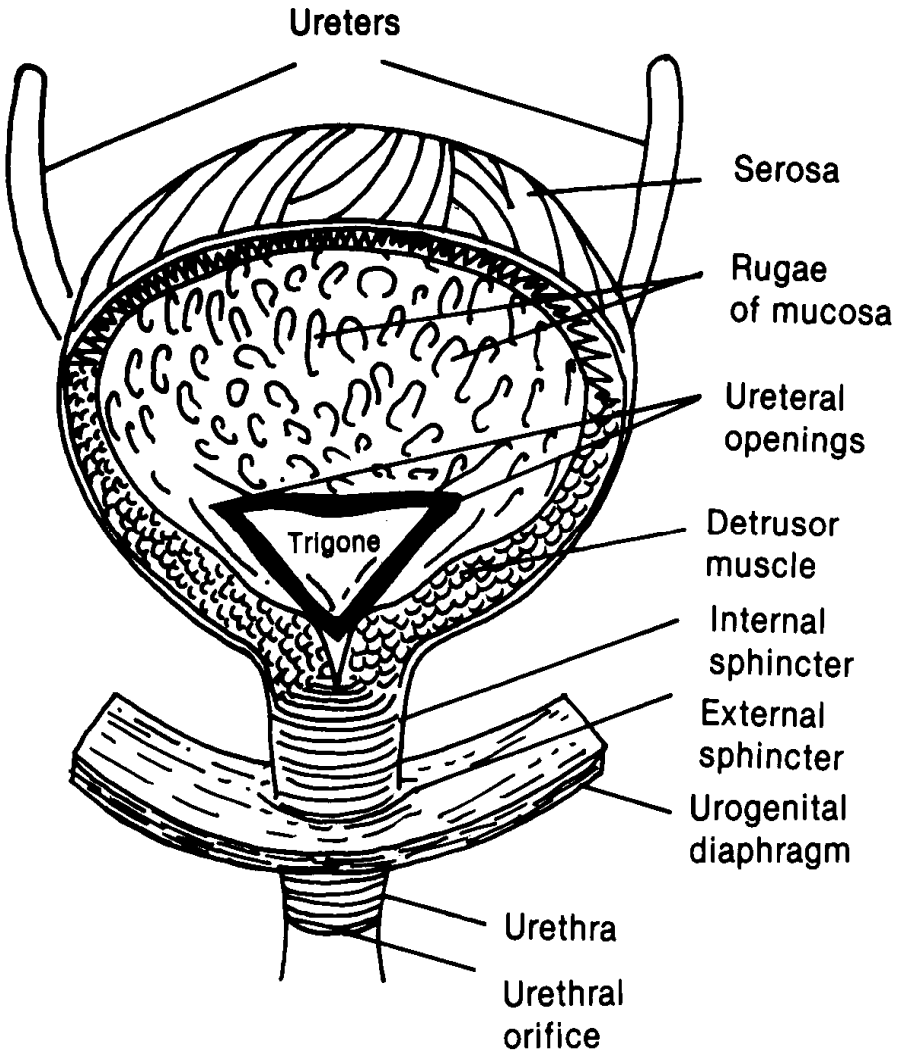

Figure 1-6. Urinary bladder and female urethra.

1-5. URINARY BLADDER

The urinary bladder is a musculomembranous sac located in the lower portion of the abdominal cavity behind the symphysis pubis. The organ is highly specialized to store urine until the urine is eliminated from the body.

a. **Trigone.** The base of the urinary bladder is known as the trigone because of its triangular shape. The trigone is fairly solid and nonstretchable. See figure 1-6.

b. **Stretchable Wall.** The rest of the wall of the urinary bladder is very stretchable and forms a spherical sac when filled.

c. **Transitional Epithelial Lining.** The mucosal lining of the urinary bladder is made up of a unique epithelium called the transitional epithelium.

(1) Voiding reflex. The transitional epithelium has the capacity to stretch to a certain degree. At the limit of its stretchability, it causes a message to be sent to the spinal cord about the fullness of the urinary bladder. This initiates the voiding reflex, which causes the urine to pass out of the body.

(2) Increments of stretching and reorganization. Often, however, it is not convenient to void (empty the bladder). Thus, after a short period of time, the transitional epithelium can reorganize itself and undergo another increment of stretching. Soon, however, the fullness message is somewhat more urgent. There can be several increments of stretching until the limit of the urinary bladder has been reached. At that limit, the urine must be voided.

1-6. URETHRA

The urethra is a tube that conducts urine from the urinary bladder to the outside of the body. This structure begins at the anterior base of the urinary bladder.

a. **Male-Female Differences.** The female urethra is short and opens directly to the outside. The male urethra, however, is much longer and has two curvatures. The male urethra is divided into three sections: prostatic, membranous, and penile. The prostatic portion enters the prostate gland. The membranous portion enters the peritoneum and the penile portion forms in the shaft of the penis.

b. **Urethral Sphincters.** The urethral sphincters are two muscular structures that prevent urine from leaving the urinary bladder. Each urethral sphincter is a circular mass of muscle tissue. Relaxation of the sphincters allows urine to be forced through them.

NOTE: Remember the difference between the ureter and the urethra. The ureter is a tube draining urine from the kidneys to the urinary bladder. The urethra is a tube draining urine from the urinary bladder to the outside.

1-7. URINE

Urine is a by-product of the kidney's activity. Volume, pH, and solute concentration vary with the needs of the body's internal environment in a healthy person. The characteristics of urine may change greatly when a person is ill. It is possible to find out a great deal about the state of a body by analyzing the volume, physical properties, and chemical properties of urine.

a. **Physical Characteristics.** Normal urine is yellow or amber colored and transparent. The color, caused by pigments from the metabolism of bile, can change because of medication or diet. A person eats beets and his urine may be a reddish color. An individual takes large amounts of vitamin C and his urine may be deep yellow for a time. The odor of urine varies. Stale urine develops an ammonia odor (think of a baby's diaper), but the urine that is expelled after the digestion of asparagus will have a completely different, but characteristic, odor.

b. **Composition.** About 95 percent of the total volume of urine is water. The other 5 percent is made up of solutes that come from cellular metabolism and outside sources such as drugs. Included in the 5 percent are nitrogenous waste products, electrolytes, toxins, and urea. Urea, an end product formed in the liver from protein metabolism, is the chief nitrogenous waste product in the non-water portion of urine.

NOTE: One of the screening tests for renal function is the blood urea nitrogen (BUN) test. It is the most commonly ordered test. It measures blood levels of nitrogen in urea. This test is not sensitive to mild degrees of renal dysfunction, but it is a good clinical indication of significant renal dysfunction.

c. **Specific Gravity.** This is the ratio of the weight of a volume of a substance to the weight of an equal volume of distilled water. The specific gravity of water is 1.000. The specific gravity of urine depends on the amount of solid materials in the urine. The specific gravity of normal urine ranges from 1.010 to 1.020. The greater the concentration of solutes in the urine, the higher its specific gravity.

d. **Amount Voided.** A normal adult eliminates about 1500 cubic centimeters of urine daily. The amount of urine voided depends on a number of factors: blood pressure, blood concentration, diet, temperature, diuretics, mental state, and general health.

e. **Acidity/Alkalinity of Urine.** Normal urine is slightly acid, but the acidity and alkalinity of urine varies greatly with an individual's diet. A high-protein diet increases the acidity of urine while a diet consisting of mostly vegetables increases the alkalinity of urine. Other factors influencing urinary pH include high altitude, fasting, and exercise.

1-8. MALE GENITAL SYSTEM

a. **External Genitalia.** The penis and the scrotum are the external parts of the male genital system. See figure 1-7.

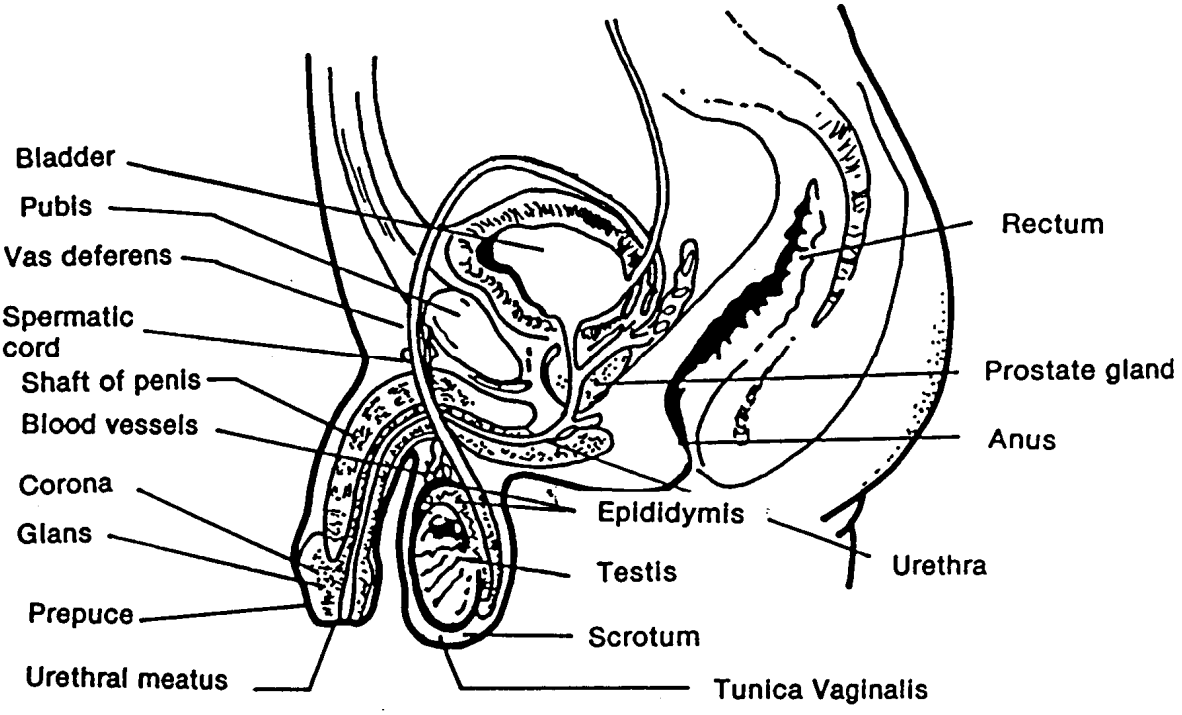

Figure 1-7. Male genital system.

(1) Penis. The penis is the male organ of copulation and urination. The shaft of the penis is made up of three cylindrical masses of tissue bound together by fibrous tissue. The two back and side tissue masses are called the corpora cavernosa penis. The smaller third tissue mass is the corpus spongiosum penis located toward the middle of the shaft and containing spongy urethra. These three tissue masses are erectile (capable of erection) and contain blood sinuses (channels). When sexually stimulated, the arteries of the penis dilate. Large quantities of blood enter the blood sinuses. Expansion of these spaces compresses the veins draining the penis, causing most entering blood to be retained. An erection is caused by these vascular changes, the erection being a parasympathetic reflex. When the arteries constrict and the pressure on the veins is relieved, the penis returns to its flaccid (soft, limp) state. See figure 1-8.

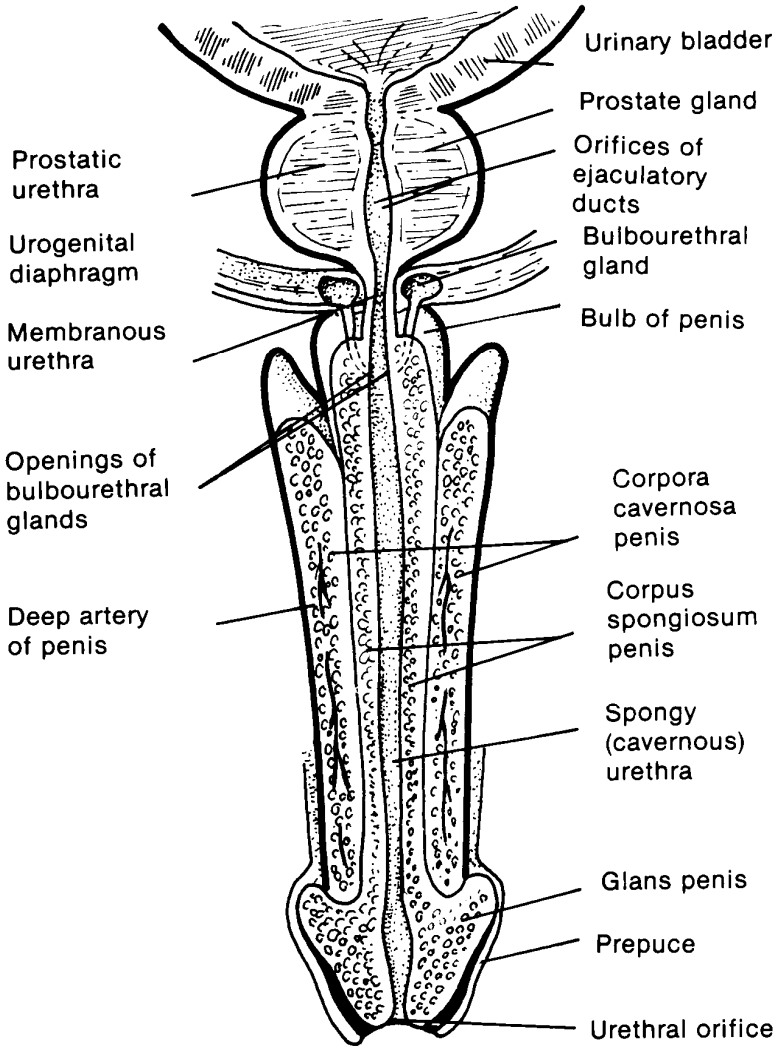

Figure 1-8. Internal structure of the penis.

(2) Glans. The terminal enlarged end of the penis is called the glans. (The word glans means shaped like an acorn.) This portion of the penis is formed by that part of the spongy body that extends beyond the cavernous bodies of the penis shaft. The glans is highly innervated (tactile).

b. **Internal Genitalia.** Internal genitalia include the testes, epididymis, vas deferens, ductus deferens, seminal vesicles, ejaculatory duct, prostrate gland, bulbourethral (Cowper's) gland, and the urethra.

(1) Testes. The testes are the primary organs of reproduction in the male. The male testes correspond to the female ovaries. Located in the scrotum, the testes are oval structures enclosed in a fibrous capsule. A dense layer of white fibrous tissue called the tunica albuginea covers the testes. This tissue layer extends inward and divides each testis into a series of internal compartments called lobules. Each of the 200 to 300 lobules contains one to three tightly coiled tubules called the seminiferous tubules. These tubules produce sperm by a process called spermatogenesis. Interstitial cells within the testes produce testosterone, the hormone that is essential for the development of the male secondary sex characteristics. Growth of hair on the face and body, deepening of the voice, and an increase in skeletal muscle mass do not occur in a male whose body does not produce testosterone.

(2) Epididymis. At the upper and posterior part of each testes is located an epididymis, an elongated triangular tube which is 16 to 20 feet in length. Each of these two tubes is tightly coiled. Sperm mature in the epididymis tubes. These tubes link the testes proper with the ductus deferens. Sperm are stored in the epididymis tubes until they are ejaculated and enter the ductus (vas) deferens.

(3) Ductus (vas) deferens. At the tail of the epididymis, the epididymis becomes less coiled, its diameter increases, and the tube becomes known as the ductus (vas) deferens. Vas deferens are muscular tubes about 48 centimeters (18 inches) long. Two vas deferens, one from each epididymis tube, lead up through the inguinal canal into the pelvic cavity, cross to the inferior surface of the urinary bladder, and unite with the ducts of the seminal vesicles to form the ejaculatory ducts.

(4) Seminal vesicles. The seminal vesicles are two glandular pouches located behind and below the urinary bladder. These tubular structures secrete a substance that activates the spermatozoa in the semen. The secretions contain fructose and prostaglandins. Fructose energizes the sperm, and prostaglandins assists ejaculation and stimulates uterine contractions. Thus, both fructose and prostaglandins help sperm move to the uterine tubes where fertilization occurs. Additionally, seminal fluid is slightly alkaline and the seminal vesicles' secretions help protect sperm against the acid secretion of the vagina. Secretion of the seminal vesicles makes up 60 percent of the ejaculate. See figure 1-9.

(5) Ejaculatory duct. Each ductus deferens and its corresponding seminal vesicle coverage to form a short tube called the ejaculatory duct. The ejaculatory duct opens into the urethra within the prostate gland. The ejaculatory duct carries both sperm and seminal vesicle fluid.

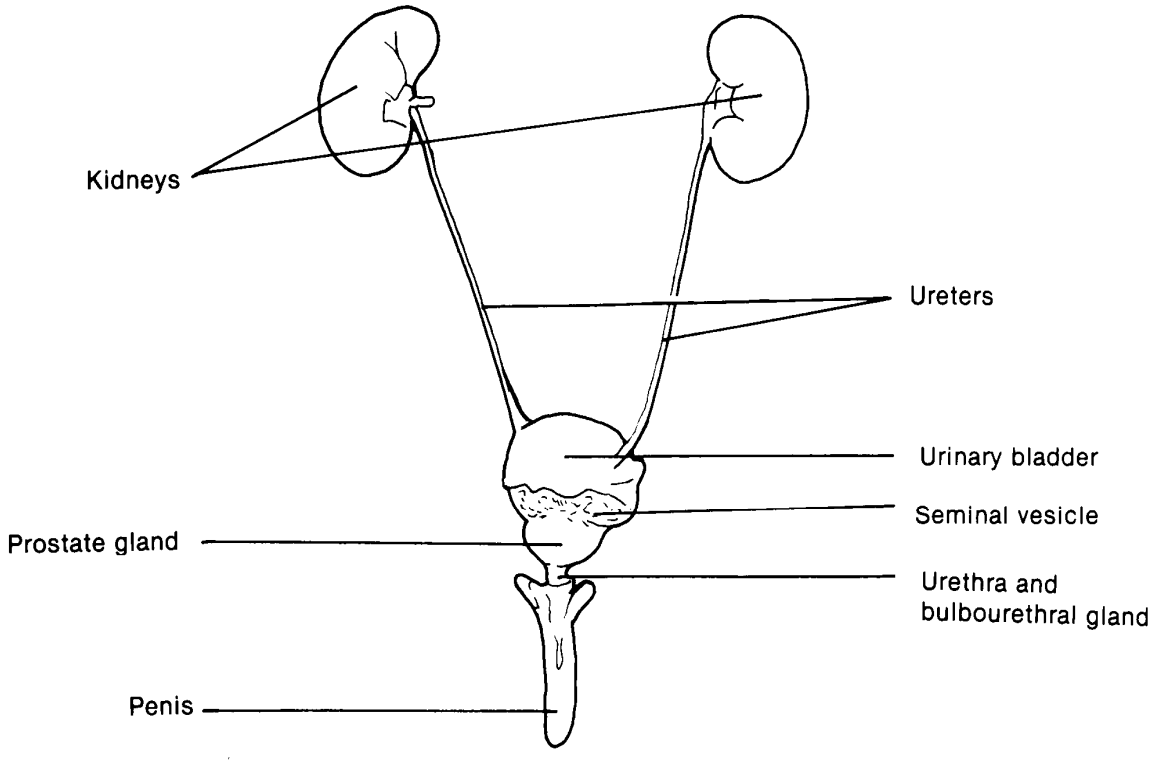

Figure 1-9. Seminal vesicles and other male organs of the genitourinary system.

(6) Prostate gland. This gland is a single doughnut-shaped gland about the size of a chestnut. The gland lies directly below the urinary bladder and surrounds the prostatic part of the urethra. The prostate gland secretes a highly alkaline fluid that protects sperm acidity in the urethra and vagina. Secretion from the prostate gland is added to the sperm and seminal vesicle fluid. From 13 to 33 percent of the volume of semen seminal vesicle fluid is prostate gland secretion. Prostate gland secretion also contributes to sperm motility.

(7) Bulbourethral (Cowper's) glands. These are two small glands, about the size of peas, located just below the prostate on either side of the urethra. These glands secrete a mucous-like lubricating fluid into the membranous urethra. The glands also secrete a substance that neutralizes urine. Ducts of these glands open into the spongy urethra.

(8) Urethra. The urethra is a passageway for sperm and urine. The urethra, measuring about 20 centimeters (8 inches) in length, passes through the prostate gland, the urogenital diaphragm, and the penis.

1-9. FEMAL GENITAL SYSTEM

a. **External Genitalia.** The vulva and its parts make up the external genitalia. The word vulva is a term that has been designated to stand for the external genitalia of the female. See figure 1-10.

(1) Mons pubis. The elevated, fatty tissue covered with coarse pubic hair and which lies over the symphysis pubis is the mons pubis. Pubic hair appears at puberty. The function of the mons pubis is to protect the pelvic bone.

(2) Labia majora. The labia majora are large longitudinal folds of skin and fatty tissue extending back from the mons pubis to the anus. The outer surfaces are covered with hair. The inner surfaces are smooth and moist. The corresponding structure in the male is the scrotum. The function is to protect the entrance to the vagina.

(3) Labia minora. The labia minora is composed of two folds of skin lying within the labia majora and enclosing the vestibule. In front, each labium minus (minus is the singular form of minora) divides into two folds. The fold above the clitoris is called the prepuce of the clitoris. The fold below is the frenulum. No pubic hair is on these structures:

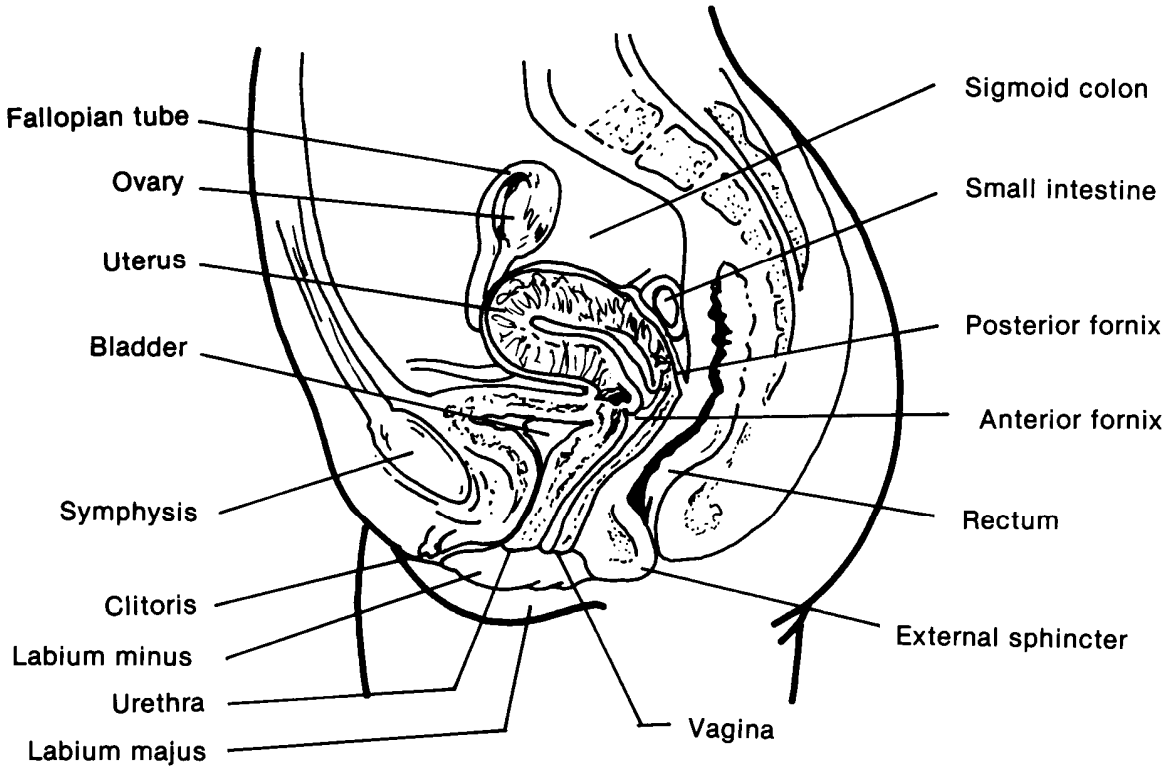

Figure 1-10. Female genital system.

(4) Clitoris. The clitoris is a small projection of sensitive erectile tissue, which corresponds to the male penis. The female urethra, however, does not pass through the clitoris. As in the male penis, the clitoris is covered by prepuce.

(5) Urinary meatus. The urinary meatus is located between the clitoris and the vagina.

(6) Vaginal orifice. This is the opening to the vagina from the outside.

(7) Bartholin's gland. These are bean-shaped glands located on each side of the vaginal orifice. They provide lubrication of the vagina.

(8) Perineum. The perineum is the area between the vaginal orifice (opening) and the rectum. The perineum is sometimes referred to as the pelvic floor.

b. **Internal Genitalia.** See figure 1-10.

(1) Uterus or "womb." The uterus is a hollow, muscular, pear-shaped organ. It is located in the pelvic cavity between the urinary bladder and the rectum. During a woman's child-bearing years, the uterus is about 7.5 centimeters long, 5 centimeters wide, and 2.5 centimeters thick. The three anatomical divisions of the uterus are the fundus, the body, and the cervix. The fundus is the upper, convex part of the uterus. This part of the uterus is located just above the entrance to the fallopian tubes. The body is the central part of the uterus and the cervix is the lower, neck-like part of the uterus.

(a) Walls of the uterus. The walls of the uterus are made up of three layers: the endometrium, the myometrium, and the parietal peritoneum. The endometrium, the inner layer, attaches itself to the myometrium layer and lines the uterus. This layer is sloughed off during menstruation or post delivery. The middle layer, which is composed of smooth muscle, is the myometrium. This layer is made up of longitudinal, circular, and spiral muscular fiber that interlaces. This middle layer of wall is thickest in the fundus and thinnest in the cervix. During childbirth, this muscle layer is capable of the very powerful contractions necessary for a normal birth. The third layer, the parietal peritoneum, is the outer layer and is a serous membrane (a membrane that lines body cavities but does not open to the exterior). This layer of wall is incomplete and covers only part of the uterine body and none of the uterine cervix.

(b) Functions of the uterus. The uterus holds the fertilized egg during its growth and development during pregnancy. The fetus grows in the uterus. During the birth process, the uterus produces powerful contractions to expel the mature infant. And, finally, during a female's menstrual phase, fluid is discharged from the uterine cavity. Three functions of the uterus are, therefore, pregnancy, labor, and menstruation.

(2) Uterine tubes, fallopian tubes, or oviducts.

(a) Description/information. These two tubes, known by all three names listed above, extend from the uterus to the ovaries. The ova move from the ovaries along these tubes to the uterus. The tubes are about 10 centimeters (4 inches) long and are positioned between the folds of the broad ligaments of the uterus. The tubes are attached to the uterus at one end but not attached to the ovaries at the other end. At the ovary end, the tubes are open and funnel-shaped and close to the ovary. The funnel-shaped end of the tubes are called the infundibulum. At these ends are fringe or finger-like processes called fimbriae. The outer edge of the infundibulum are continuous with the peritoneum (the largest serous membrane of the body).

(b) Description/information. These two tubes, known by all three names listed above, extend from the uterus to the ovaries. The ova move from the ovaries along these tubes to the uterus. The tubes are about 10 centimeters (4 inches) long and are positioned between the folds of the broad ligaments of the uterus. The tubes are attached to the uterus at one end but not attached to the ovaries at the other end. At the ovary end, the tubes are open and funnel-shaped and close to the ovary. The funnel-shaped end of the tubes are called the infundibulum. At these ends are fringe or finger-like processes called fimbriae. The outer edge of the infundibulum are continuous with the peritoneum (the largest serous membrane of the body).

(3) Ovaries.

(a) Description/information. The ovaries are two almond-shaped glands located on either side of the uterus below and behind the uterine tubes. Detached from the uterine tubes, the ovaries are held in position by a series of ligaments. During the second phase of the menstrual cycle, one of the 20 to 25 primary follicles that has developed in an ovary, matures into a Graafian follicle, a follicle ready for ovulation. During the maturation process, this follicle increases its estrogen production. The rupture of the Graafian follicle, with the release of the ovum, is the beginning of ovulation.

(b) Functions. A major function of the ovaries is to produce ova (female reproductive cells capable of developing, after fertilization, into new individuals). Other functions include discharge of ova (ovulation) and secretion of the female sex hormones, which are progesterone, estrogen, and relaxin. The ovaries in the female correspond to the testes in the male reproductive system.

(4) Vagina.

(a) Description/information. The vagina is a muscular, tubular organ lined with mucous membrane. This organ is about 10 centimeters (4 inches) long and extends from the hymen to the cervix. The vagina extends upward and backward between the rectum and the bladder and is attached to the uterus.

(b) Structure. The lining of the vagina is made up of smooth muscle that is longitudinally and circularly arranged in many folds called rugae. The folds of the lining permit the organ to expand when necessary. The hymen is the fold of mucous membrane at the orifice (opening) of the vagina.

(c) Function. The vagina serves as a passageway for menstrual flow, receives seminal fluid from the male, and serves as the lower part of the birth canal.

Continue with Exercise

EXERCISES, LESSON 1

INSTRUCTIONS. Answer the following exercises by writing the answer in the space provided.

After you have completed all of these exercises, turn to "Solutions to Exercises" at the end of the lesson and check your answers. For each exercise answered incorrectly, reread the material referenced with the solution.

1. What is the primary function of the urinary system?

   _____

   _____.

2. List the major parts of the urinary system.

   a. _____.

   b. _____.

   c. _____.

   d. _____.

3. List three functions of the kidneys.

   a. _____.

   b. _____.

   c. _____.

4. The notch near the center of the rounded border of each kidney is called the:

   _____.

5. The collecting point for urine in the kidney is called the:

   _____.

6. List the three important functions carried out by the nephron units in the kidneys.

   a. _____.

   b. _____.

   c. _____.

7. Where is the urinary bladder located?

   _____.

8. Name the reflex that causes urine to pass out of the body.

   _____.

9. What is the difference between the female urethra and the male urethra?

   _____.

   _____.

10. The two muscular structures which prevent urine from leaving the urinary bladder are the _____.

11. Approximately 95 percent of the total volume of urine is _____.

12. The blood urea nitrogen (BUN) test is a screening test for

    _____.

13. SSG Gilmore is following a high-protein diet. What effect will this diet have on the acidity of his urine?

    _____.

14. Name the terminal enlarged end of the penis.

_____.

15. The two glandular pouches located behind and below the urinary bladder are the

_____.

16. Two pea-shaped glands located just below the prostate on either side of the urethra in the male secrete a substance that neutralizes urine. These glands are the _____.

17. What is the hollow, muscular, pear-shaped organ located in the pelvic cavity between the urinary bladder and the rectum of the female?

_____.

18. List the three functions of the uterus.

a. _____.

b. _____.

c. _____.

19. The _____ tubes extend from the uterus to the ovaries.

20. What hormones do the ovaries secrete?

a. _____.

b. _____.

c. _____.

21. List the three functions of the vagina.

a. _____.

b. _____.

c. _____.

Check Your Answers on Next Page

SOLUTIONS TO EXERCISES, LESSON 1

1. The primary function of the urinary system is to help keep the body in homeostasis by controlling the composition and volume of blood. (para 1-2)

2. Two kidneys.
   Two ureters.
   One urinary bladder.
   One urethra. (para 1-2)

3. You are correct if you listed any three of the following:

   Filtration of metabolic wastes.
   Urine formation.
   Fluid and electrolyte balance.
   Acid base balance.
   Influence blood pressure. (para 1-3a)

4. Hilium. (para 1-3c)

5. Renal pelvis. (para 1-3d)

6. Control blood concentration and volume by removing selected amounts of water and solutes.
   Help regulate blood pH.
   Remove toxic wastes from the blood. (para 1-3e(3)(a)1, 2, 3)

7. The urinary bladder is located in the lower portion of the abdominal cavity behind the symphysis pubis. (para 1-5)

8. The voiding reflex. (para 1-5c(1))

9. The female urethra is short and opens directly to the outside. The male urethra is much longer and has two curvatures. (para 1-6a)

10. Urethral sphincters. (para 1-6b)

11. Water. (para 1-7b)

12. Renal function. (para 1-7b, NOTE)

13. There will be increased acidity of his urine. (para 1-7e)

14. The glans. (para 1-8a(2))

15. Seminal vesicles. (para 1-8b(4))

16. Bulbourethral or Cowper's glands. (para 1-8b(7))

17. Uterus. (para 1-9b(1))

18. Holds the fertilized egg during its growth and development during pregnancy.
Produces powerful contractions to expel the mature infant during labor.
Fluid is discharged from the uterine cavity during a female's menstruation.
(para 1-9b(1)(b))

19. Uterine , fallopian , or oviducts. (para 1-9b(2)(a))

20. Progesterone.
Estrogen.
Relaxin. (para 1-9b(3)(b))

21. Passageway for menstrual flow.
Receives seminal fluid from the male.
Serves as lower part of the birth canal. (para 1-9b(4)(c))

End of Lesson 1

LESSON ASSIGNMENT

LESSON 2	Physical Assessment of the Genitourinary System
LESSON ASSIGNMENT	Paragraphs 2-1 through 2-4.
LESSON OBJECTIVES	After completing this lesson, you should be able to:

2-1. Identify historical data pertinent to the physical genitourinary assessment of the genitourinary system.

2-2. Identify the procedures for performing a physical assessment of the male and female genitourinary systems.

SUGGESTION After completing the assignment, complete the exercises at the end of this lesson. These exercises will help you to achieve the lesson objectives.

LESSON 2

PHYSICAL ASSESSMENT OF THE GENITOURINARY SYSTEM

2-1. INTRODUCTION

Genitourinary (GU) problems are fairly common and tend to occur in all age groups. If neglected, these problems can lead to severe pain, morbidity, or even death. This lesson will teach you ways to approach and assess the GU problem or complaint in a very systematic way and to complete a patient history relevant to the genitourinary assessment.

2-2. PATIENT'S GENITOURINARY HISTORY

The purpose of taking a patient's history is to learn about the patient so that his present problem can be diagnosed and treated. Generally, taking the patient's history proceeds by obtaining information from him in these areas--the chief complaint, the present problem, past medical history, and family history. Some specific questions can be asked of the patient to obtain necessary information about him.

a. **Chief Complaint.** Ask the question, "What problem or symptoms brought you here?" Then ask, "How long has this problem been present?" or "When did these symptoms begin?"

b. **Present Problem or Illness.** Ask for the signs and symptoms of the problem. When did the patient last feel well? What things make the problem worse? What makes the patient feel better? How does the problem affect the patient's lifestyle (marriage, leisure activities, ability to perform tasks, ability to cope with stress)? How has the problem progressed up to the present point (steadily worsening or periods of being better followed by periods of worsening)?

c. **Information Specific to the Genitourinary System.** The genitourinary history of a patient should include certain pertinent information as follows:

(1) Urinary system.

(a) Trauma.

(b) Infections or diseases.

(c) Incontinence (inability to control bladder and/or bowel functions).

(d) Physical abnormalities.

(e) Venereal history (also affects the reproductive system).

(f) Dysuria (difficulty or pain in urination).

(2) Reproductive system. Obtain information about the following:

(a) Menstrual history of a female should include information about her last menstrual period (LMP) and post-menstrual pain (PMP). Ask the number of times she has been pregnant (gravida), the number of pregnancies carried past 20 weeks (para), and the number of abortions (AB).

(b) Fertility (asked of both men and women).

(c) Potency and libido. Questions about potency and libido are usually asked in very extensive histories. DO NOT question a patient about these areas in a routine physical examination.

2-3. PROCEDURES FOR PHYSICAL ASSESSMENT OF THE GENITOURINARY SYSTEM

The physical assessments of the genitourinary system for the male and female have similarities and differences. Procedures for assessment of the rectal areas are the same for each gender.

a. **Male Genitalia Inspection.** Examine as follows:

(1) Examine the foreskin by retraction. Check for phimosis (constriction of the preputial orifice so that the prepuce cannot be retracted over the glans).

(2) Look for lesions, chancres (primarily sores associated with syphilis).

(3) Examine the glans for ulcers, scars, and inflammation.

(4) Check the location of the urethra. A congenital defect that appears in the male is hypospadias in which the urethra opens on the undersurface of the penis. Epispadias is a congenital defect that can occur in males and females. In the male, the urethra opens on the dorsal side of the penis; in the female, there is a fissure in the upper wall of the urethra.

(5) Check for discharge from the meatus.

(6) Examine the skin around the base of the penis for inflammation, nits, or lice.

(7) Check the scrotum for swelling and inflammation.

b. **Male Genitalia Palpation.** Examine as follows:

(1) Testes. Check the testes for:

(a) Masses that are tender.

(b) Tumors that won't transluminate.

(c) Spermatocele (tumor of the testes).

(d) Varicocele (swelling that feels like a bag of worms in the scrotum).

(2) Epididymis. Check for:

(a) Soft mass of tissue posterior to the testicle.

(b) Epididymitis (inflammation of the epididymis).

(3) Direct inguinal hernia. Check for a bulge. A large bulge is rare. A minor bulge may only be felt with the finger in the inguinal canal.

(4) Indirect inguinal hernia. Examine as follows:

(a) Protrusion of abdominal contents through the inguinal canal and often into the scrotum.

(b) Indirect hernia can resolve on recumbent position.

c. **Female Genitalia Inspection.** Follow this procedure:

(1) Ensure proper equipment (speculum, lubricant, gloves) is set up.

(2) Have the patient void (to avoid discomfort during the examination).

(3) Be sure a chaperon is available.

(4) Check the external genitalia using a gloved hand.

(5) Check for inflammation, discharge, swelling, or ulceration of the following:

(a) External genitalia (with a gloved hand): labia minora, clitoris, urethral opening, and vaginal opening.

(b) Internal genitalia (examine with a speculum): vagina and cervix.

(6) Check to see if laboratory specimens for a pap smear or other scrapes/swab tests are needed.

d. **Male and Female Rectal Inspection.** Examine as follows:

(1) Palpate the rectum.

(2) Check for lesions on the rectal walls.

(3) Check a stool for blood.

2-4. CLOSING

Since ancient times, man has recognized the seriousness of genito-urinary problems. Today, with all of our modern technology, we can identify and treat many of these conditions that have resulted in death in the past. The transplanting of kidneys is only one of the many modalities available to us. But a complete and thorough history and physical examination is still one of our most valuable tools. Such an examination can be your faithful companion if you master it.

Continue with Exercises

EXERCISES, LESSON 2

INSTRUCTIONS. Answer the following exercises by writing the answer in the space provided.

After you have completed all of these exercises, turn to "Solutions to Exercises" at the end of the lesson and check your answers. For each exercise answered incorrectly, reread the material referenced with the solution.

1. The genitourinary history of a patient should include trauma, infections or diseases, incontinence, physicalabnormalities, Dysuria (difficulty or pain in urination) and _____.

2. Menstrual history of a female should include information about her last menstrual period (LMP) and post-menstrual pain (PMP). A female patient should be asked how many pregnancies she has carried past _____ weeks.

3. What questions about reproductive system should not be asked to a patient during a routine physical examination?

   _____.

4. Examine a male's glans for inflammation, ulcers, and _____.

5. Examine female external and internal genitalia for discharge, ulcerations, inflammation, and _____.

6. Equipment you should gather before inspecting the female genitalia includes lubricant, speculum, and _____.

7. Female external genitalia examined with a gloved hand include the clitoris, labia minora, vaginal opening, and _____.

8. List the three parts of the male and female rectal examination.

   a. _____.

   b. _____.

   c. _____.

9. Checking for spermatocele and varicocele are done during _____.

10. A bulge anterior to the scrotum may indicate the patient has a _____

Check Your Answers on Next Page

SOLUTIONS TO EXERCISES, LESSON 2

1. Venereal history (also affects the reproductive system). (para 2-2c(1)(a) - (e))

2. 20. (para 2-2c(2)(a))

3. Libido and potency. (para 2-2c(2)(c))

4. Scars. (para 2-3a(3))

5. Swelling. (para 2-3c(5))

6. Gloves. (para 2-3c(1))

7. Urethral opening. (para 2-3c(5)(a))

8. Palpate the rectum.
   Check for lesions on the rectal walls.
   Check a stool for blood. (para 2-3d(1) - (3))

9. Male genitalia palpation. (para 2-3b(1)(c), (d))

10. Direct inguinal hernia. (para 2-3b(3)(b))

End of Lesson 2

LESSON ASSIGNMENT

LESSON 3 Urinary System Diseases/Disorders

LESSON ASSIGNMENT Paragraphs 3-1 through 3-37.

LESSON OBJECTIVES After completing this lesson, you should be able to:

3-1. Identify the etiology, signs, symptoms, and treatment for urinary tract infections.

3-2. Identify the etiology, signs, symptoms, and treatments for these kidney diseases/disorder.

- a. Acute glomerulonephritis.
- b. Pyelonephritis.
- c. Hydronephrosis.
- d. Acute renal failure.
- e. Chronic renal failure.
- f. Renal tumors.
- g. Polycystic kidney.
- h. Renal calculi.

3-3. Identify the etiology, signs, symptoms, and treatments for abnormalities and obstructions of the ureters.

3-4. Identify the etiology, signs, symptoms, and treatments for these bladder disorders:

- a. Cystitis.
- b. Tumors.

3-5. Identify these disorders of the urethra:

- a. Congenital defects.
- b. Urethritis.
- c. "Straddle Injuries."
- d. Trauma.

3-6. Identify the etiology, signs, symptoms, and treatments for injuries to these organs of the genitourinary system:

a. Kidney injuries.
b. Bladder injuries.
c. Urethral injuries.

3-7. Identify adverse reactions and contraindications that apply to a specific drug treatment for urinary system diseases and disorders.

SUGGESTION

After completing the assignment, complete the exercises at the end of this lesson. These exercises will help you to achieve the lesson objectives.

LESSON 3

URINARY SYSTEM DISEASES/DISORDERS

Section I. URINARY TRACT INFECTIONS

3-1. INTRODUCTION

More than 8 million Americans are affected by urinary system related health problems, which means you may deal with many patients with urinary system complaints. The urinary system plays a major part in the fluid and electrolyte balance of the body and with the respiratory system is important in maintaining the blood pH. It is understandable, therefore, that a problem with the urinary system can have serious health consequences.

3-2. ETIOLOGY OF URINARY TRACT INFECTIONS

a. **Infecting Microorganisms.** The cause of urinary tract infections (UTI) can be traced to the presence of infectious microorganisms located anywhere between the kidneys and the urethral opening. The common pathogens are the gram-negative bacilli, often found in the colon, especially E. coli, klebsiella, and proteus. Microorganisms acquire access to the kidneys by ascension from the lower urinary tract beginning at the urethra. Bacterial infections of the lower urinary tract occur about 10 times more frequently in females than in males. A common cause of urinary tract infection in females is an improper wiping technique.

b. **Predisposing Factors.** Factors which predispose an individual to UTI include sex, stasis of the urine, instrumentation, and neurogenic bladder.

(1) Sex of the individual. Urinary tract infections are common in females of all ages because the female urethra is short. Additionally, large numbers of pyogenic bacteria (pus-producing bacteria) inhabit the vaginal vestibule. Urinary tract infections are rare among males less than 50 years old because the male urethra is enclosed in the penis. Ascending UTI infections frequently occur after intercourse.

(2) Urinary stasis. Urinary stasis is the stoppage of the flow or discharge of urine. This condition may be caused by stones, stricture (an abnormal narrowing of a tubular structure), prostatic enlargement, tumor, or developmental abnormalities. Urinary stasis may occur at any level of the urinary tract. The statis of urine from any cause predisposes toward UTI. About 95 percent of people with catheters for three days develop urinary tract infections.

(3) Instrumentation. Instrumentation used (such as catheters), diagnostic studies, and therapeutic procedures (such as bladder irrigations) are also causes of urinary tract infections.

(4) Neurogenic bladder. Neurogenic bladder is the term used for any disturbance of the bladder function that is caused by impairment of the nerve supply. Such dysfunction can occur by prolonged urinary stasis in the bladder but is more frequently caused by the use of catheters.

3-3. SIGNS AND SYMPTOMS OF URINARY TRACT INFECTIONS

Pain, a primary symptom associated with urinary tract infection, involves the kidneys, the ureter, and the bladder. Kidney pain will be manifested as a dull ache in the flanks extending along the rib margin toward the umbilicus. (The flank is the side of the body between the ribs and the pelvis.) In the ureter, pain radiates from the costovertebral angle down the course of the ureter to the scrotum or vulva to the inner thighs. During urination, the individual experiences bladder pain that radiates to the distal urethra.

3-4. LABORATORY PROCEDURES FOR URINARY TRACT INFECTIONS

Common laboratory procedures for urinary tract infection include the following: routine analysis, culture sensitivity, blood tests, cystoscopic examination, and X-ray procedures.

a. **Routine Analysis.** Routine analysis is done to check for abnormalities. A routine analysis includes a check of the following:

(1) Specific gravity for testing the kidney's ability to concentrate urine.

(2) pH-balance to reflect the metabolic status.

(3) Presence of white blood cells, red blood cells, crystals, and casts (a menstruating female will normally have red blood cells present).

(4) Glucose that is indicative of diabetes. Many drugs give false positive tests for glucosuria. Examples of such drugs include Kelflex®, large doses of ascorbic acid, penicillin, Benemid R®, tetracycline, and thiazides.

(5) Odor (a sweet smell) with a presence of acetone is associated with diabetes mellitus, while an unpleasant smell is associated with decomposition or ingestion of certain drugs or foods.

(6) Color and transparency. Pale urine indicates diabetes insipidus. If the urine is milky, there may be fat globules or pus corpuscles present. Reddish urine may indicate the presence of blood pigments, drugs, or food pigments. Greenish urine is indicative of bile pigment, which is associated with jaundice. Brown-black urine may indicate poisoning or hemorrhage.

b. **Specimens.** Culture and sensitivity (clean catch) specimens are taken to determine specific agents in infectious diseases of kidneys, ureters, and bladder. Good cleaning techniques are essential, especially in women. In such cases, void and collect midstream urine in a sterile cup. The patient can be catheterized (in and out catheterization), but this is the last resort because of increased incidence of introducing UTIs with catheterization. Specimens must be sent to the laboratory as soon as possible and refrigerated, if needed.

c. **Additional Procedures.**

(1) Blood urea nitrogen (BUN). This is a blood test to help determine whether the kidneys are clearing the body of waste properly. The body's blood chemistry changes if the nephrons of the kidneys are not removing the body's waste products efficiently. One change in blood chemistry is a rise in the blood urea nitrogen level.

(2) Cystoscopic examination. The cystoscopic examination is a direct method of bladder study and visualization by cystoscopy using a tubular lighted telescopic lens that is passed into the bladder via the urethra. It is used to detect tumors, obtain biopsies, remove calculi (kidney stones), treat lesions, and inspect tissue.

(3) X-ray procedures. X-ray procedures includes the kidney, the ureter, and the bladder (KUB) or flat plate of the abdomen. It shows the position, size, and shape of the kidneys and renal calculi.

Section II. KIDNEY DISEASES AND DISORDERS

3-5. GENERAL INFORMATION

Kidney disorders may be acute or chronic. Acute conditions usually arise suddenly, most frequently as the result of an infection with inflammation of the nephrons. Acute kidney disorders commonly run a course of a few weeks and are followed by complete recovery. Chronic kidney conditions develop slowly. These are often progressive, resulting in the gradual loss of kidney function.

3-6. ACUTE GLOMERULONEPHRITIS

Glomerulonephritis, a form of nephritis (inflammation of the kidneys) in which the lesions involve primarily the glomeruli, is the most common kidney disease. In this disease, antibodies formed in response to streptococci attach themselves to the glomerular membrane and injure this membrane. (Glomeruli are the small, coiled mass of blood capillaries within Bowman's capsule of the kidney.) These damaged glomeruli allow protein, especially albumin, to filter into Bowman's capsule and, ultimately, to appear in the urine (albuminuria). The damaged glomeruli also allow red blood cells to filter into the urine (hematuria). The patient usually recovers without permanent kidney damage. Sometimes, however, particularly in adult patients, the disease becomes chronic with a gradual decrease in the number of functioning nephrons. This condition leads to chronic renal failure.

a. **Etiology of Acute Glomerulonephritis.** The exact cause of this infection is unknown. What is known is that a glomerulonephritis infection frequently follows other infections, especially those of the upper respiratory tract such as a streptococcal infection. Glomerulonephritis usually occurs in children about one to four weeks after a streptococcal infection of the throat. There is a latent period of five days to six weeks between an infection and the onset of nephritis (inflammation of the kidneys).

b. **Signs and Symptoms of Acute Glomerulonephritis.** A patient with acute glomerulonephritis may experience the following signs and symptoms:

(1) Hypertension (high arterial blood pressure) - mild to severe from sodium retention, water retention, or inappropriate renin release. (Renin is an enzyme released by the kidney into the blood stream, where renin has a part in raising blood pressure when blood pressure is low.)

(2) Edema (swelling because of the retention of fluid)--may be mild to severe.

(3) Hematuria (discharge of red blood cells in the urine)--resulting in smoky or coffee-colored urine.

(4) Albuminuria--abnormal amount of albumin excreted each day in the urine.

(5) Oliguria--abnormally low amount of urine excreted per day.

c. **Treatment of Acute Glomerulonephritis.** There are two goals of treatment of this infection: first, relief of the symptoms and second, prevention of complications. Treatment does not require hospitalization unless oliguria, nitrogen retention, and hypertension are present. Instead, treatment requires supportive care to include the following:

(1) Bed rest. The patient can gradually resume activities as his symptoms subside.

(2) Fluid and dietary sodium restrictions.

(3) Correction of electrolyte imbalances (possibly dialysis, although this is rarely necessary).

(4) Diuretics such as metolazone or furosemide; both will reduce the extracellular fluid overload and help control pain.

(5) An antihypertensive (an agent that reduces high blood pressure) such as hydralazine.

(6) Antibiotics administered as needed to prevent secondary infection or transmission of the infection to others.

NOTE: Information regarding this infection is important to know because acute glomerulonephritis may look like one of the treatable genitourinary diseases.

3-7. PYELONEPHRITIS

Pyelonephritis is an inflammation of the kidney pelvis and the tissue of the kidney itself. This is a renal disease that may be either acute or chronic.

a. **Acute Pyelonephritis.** This type of pyelonephritis is fairly common. It can be treated and, if the patient continues to be checked, there probably will not be extensive, permanent damage of the kidneys.

(1) Etiology of acute pyelonephritis. A bacterial infection causes the inflammation. The bacteria most commonly reach the kidney by ascending along the lining membrane from an infection in the lower part of the urinary tract. The bacterial infection may occur in these ways:

(a) From a congenital weakness at the junction of the bladder and the ureters.

(b) After instrumentation such as catheterization, cystoscopy, or urologic surgery.

(c) From an infection such as septicemia in which bacteria are carried to the kidney by blood.

(d) From an inability to empty the bladder. Patients with tumors, strictures, or benign hypertrophy cannot completely empty the bladder of urine. Bacteria can grow in such an environment.

(2) Incidence of acute pyelonephritis. The incidence of acute pyelonephritis is higher in these groups of people:

(a) Pregnant women. A small percentage of pregnant women develop bacteriuria (bacteria in the urine). If this condition is not treated, about 40 percent of these women develop pyelonephritis.

(b) Sexually active women. There is an increase in the possibility of bacterial contamination.

(c) Diabetic individuals. Some people with diabetes have a neurogenic bladder, a disorder in which the bladder does not empty completely. Bacteria may, then, grow in the urine.

(d) Individuals with other renal diseases. A person whose renal function is not operating properly from other renal diseases has an increased risk of developing pyelonephritis.

(3) Signs and symptoms of acute pyelonephritis. The signs and symptoms of pyelonephritis may be absent or obscured by an associated disease. If signs and symptoms are present, the following are typical:

(a) Urgency, frequency, and burning during urination.

(b) Urine with a fishy odor and cloudy appearance.

(c) Back and flank pain over one or both kidneys, caused by edema.

(d) Chills, fever (102° F or higher), nausea, and vomiting.

(e) Possible abdominal rigidity.

(f) Protein and casts on urinalysis.

NOTE: These symptoms may develop either over a few hours or over a few days. Even without treatment, the symptoms may disappear in a few days, but there may still be a bacterial infection. If so, the symptoms may reappear later.

(4) Treatment of acute pyelonephritis. Antibiotic therapy is the center of treatment. Start treatment after the specific infecting organism has been identified from culture and sensitivity studies of the patient's urine. Follow this treatment:

(a) Give antibiotics after urinalysis and culture and sensitivity tests have been performed.

(b) Continue antibiotics for 10 to 14 days. Inform the patient that urine usually becomes sterile in from 48 to 72 hours after he starts taking antibiotics. However, stress the importance of continuing the course of treatment for the full number of days the treatment has been prescribed.

(c) Encourage a fluid intake sufficient to achieve urinary output of more than 2,000 ml per day. While intake of fluid is important, the patient must take care not to consume too much fluid. Two to three liters of fluid should be the limit of fluid consumed by the patient. Intake of more than two or three liters of fluid may decrease the effectiveness of the antibiotics.

(d) Control fever through antipyretics (medication that reduces or relieves fever).

(e) Advise rest.

NOTE: Teach patients with a history of urinary tract infections to recognize the signs of infection such as cloudy urine, burning on urination, frequency, and urgency. Early recognition of signs of a possible infection means that the patient can seek early treatment thus preventing severe infection.

b. **Chronic Pyelonephritis.** This type of pyelonephritis is a persistent infection that can scar the kidneys and may lead to chronic renal failure. This more serious disease is frequently seen in patients with urinary tract blockage. Persistent or repeated bacterial infections may cause chronic pyelonephritis. This disease can be effectively treated with antimicrobial medication. It is very important to prevent this infection. Preventive measures include avoiding catheterization and instrumentation and practicing good hygiene.

3-8. HYDRONEPHROSIS

Hydronephrosis is distention of the renal pelvis and calyces caused by an accumulation of urine caused by an obstruction to the normal urine flow. The obstruction may occur at any level in the urinary tract.

a. **Etiology of Hydronephrosis.** The most common causes include the following:

(1) Pregnancy.

(2) An enlarged prostate.

(3) Kidney stones that have formed in the pelvis and dropped into the ureter.

(4) A tumor that presses on a ureter.

(5) Scars caused by inflammation.

b. **Signs and Symptoms of Hydronephrosis.** Signs and symptoms vary with the cause of the obstruction. Some patients experience no symptoms or slightly decreased urine output and mild pain.

(1) Severe signs and symptoms. Patients experiencing severe signs and symptoms may experience:

(a) Severe, colicky renal pain or dull, flank pain radiating to the groin.

(b) Gross urinary abnormalities such as hematuria, pyuria, dysuria, alternating oliguria and polyuria, or complete anuria.

1 Hematuria - discharge of red blood cells in the urine.

2 Pyuria - pus in the urine.

3 Dysuria - difficulty or pain in urination.

4 Oliguria - abnormally low excretion of urine.

5 Polyuria - abnormally large excretion of urine.

6 Complete anuria - no urine is excreted.

(2) Additional signs/symptoms. Included are:

(a) Nausea.

(b) Vomiting.

(c) Abdominal fullness.

(d) Pain on urination.

(e) Dribbling.

(f) Hesitancy.

NOTE: If the obstruction is only on one side, the pain may be just on one side. That pain will probably be in the flank area.

c. **Treatment of Hydronephrosis.** The two main goals of treatment are to preserve renal function and prevent infection. Both goals can be achieved by surgical removal of the obstruction. If the surgery is performed within a few weeks, before the kidney is damaged, the patient may recover completely. If the obstruction is not removed, the kidney may be permanently damaged.

3-9. ACUTE RENAL FAILURE

Acute renal failure occurs when the kidneys suddenly fail to function. As a chief organ of the excretory system, the kidney is important in the elimination of some soluble waste products from the body, and the regulation of water and electrolyte balance in the body. Renal failure stops these all-important functions, and disrupts the fine balance of the body's systems. Medical treatment can usually reverse this problem. If medication is unsuccessful, the condition may progress to end-stage renal disease, uremic syndrome, and death.

NOTE: Uremic syndrome is a condition that may appear in a patient who is in the late stages of renal failure. The skin also serves as an excretory organ. When the failed kidneys cannot excrete waste products, the skin excretes these products. This skin excretion causes a white film to form on the skin.

a. **Etiology of Acute Renal Failure.** Three classifications of acute renal failure are prerenal failure, intrinsic (or parenchymal) failure, and postrenal failure.

(1) Prerenal failure. Diminished blood flow to the kidneys causes this type of renal failure. The reason for the decreased blood flow may be any of the following:

(a) Hypovolemia.

(b) Shock.

(c) Abdominal fullness.

(d) Blood loss.

(e) Sepsis.

(f) Pooling of fluid in ascites or burns.

(g) Cardiovascular disorders such as congestive heart failure and dysrhythmias.

(2) Intrinsic (parenchymal) renal failure. This type of renal failure is caused by damage to the kidneys themselves, the damage usually resulting from acute tubular necrosis. Possible causes of such damage include:

(a) Sickle-cell disease.

(b) Acute post-streptococcal glomerulonephritis.

(c) Acute pyelonephritis.

(d) Ischemia (lack of blood in the kidneys).

(3) Postrenal failure. Obstruction of urinary flow bilaterally causes this type of renal failure. Possible causes of obstruction include:

(a) Kidney stones.

(b) Blood clots.

(c) Papillae from papillary necrosis.

(d) Tumors.

(e) Urethral edema from catheterization.

b. **Signs and Symptoms of Acute Renal Failure.** Early signs of renal failure become more severe if the kidneys do not begin functioning again. The renal failure soon disrupts other body systems. Note the signs and symptoms in the following body systems:

(1) Gastrointestinal system. - Anorexia, nausea, vomiting, diarrhea or constipation, stomatitis, bleeding, hematemesis, dry mucous members, uremic breath.

(2) Central nervous system. - Headache, drowsiness, irritability, confusion, peripheral neuropathy, convulsions, coma.

(3) Integumentary system. The cutaneous skin layer has these characteristics: dryness, pruritus, pallor, purpura, and, rarely, uremic frost.

(4) Cardiovascular system. An early symptom is hypotension. Later, these signs and symptoms occur: hypertension, dysrhythmias, fluid overload, congestive heart failure, systemic edema, and anemia.

(5) Respiratory system.--Deep or rapid respirations caused by metabolic acidosis and, occasionally, pulmonary edema.

c. **Most Commonly Seen Signs and Symptoms of Acute Renal Failure.** As a 91W30, you are most likely to see these signs and symptoms of renal failure:

(1) Mental disturbances such as confusion, lethargy, and stupor.

(2) Less than 30 cc an hour urine output despite replacement.

(3) Respiratory conditions such as respiratory muscle paralysis.

(4) Cardiac problems such as tachycardia and dysrhythmias.

(5) Fever and chills.

d. **Treatment of Acute Renal Failure.** Treatment for acute renal failure in the Intensive Care Unit consists of the following:

(1) Initiate an IV of 0.9 percent normal saline.

(2) Check urinary output hourly.

(3) Restrict 24-hour fluid intake.

(4) No medications.

(5) Possible hemodialysis (removal of waste materials/poisons from the blood by means of a hemodialyzer, a piece of equipment commonly called an artificial kidney).

3-10. CHRONIC RENAL FAILURE

Chronic renal failure, usually the end result of a gradually progressive loss of renal function, is caused by the gradual loss of nephrons. As more and more nephrons are destroyed, the kidneys gradually lose the ability to perform their normal functions. Without treatment, uremic toxins can accumulate and cause potentially fatal physiologic changes in all the major organ systems of the body.

a. **Etiology of Chronic Renal Failure.** The causes of chronic renal failure include:

(1) Chronic glomerular disease such as glomerulonephritis.

(2) Chronic infections such as tuberculosis.

(3) Vascular diseases such as hypertension.

(4) Obstructive processes such as calculi.

(5) Collagen diseases such as systemic lupus erythematosus.

(6) Endocrine diseases such as diabetic neuropathy.

b. **Signs and Symptoms of Chronic Renal Failure.** Characteristic signs and symptoms of chronic renal failure include:

(1) Dehydration - excessive loss of body fluid. Dehydration may occur early in renal failure when the kidneys cannot concentrate the urine and large amounts of water are eliminated.

(2) Edema - accumulation of fluid in the tissue spaces. This condition may occur late in chronic renal diseases when the kidneys cannot eliminate water in adequate amounts.

(3) Hypertension - high arterial blood pressure. Hypertension may occur as the result of fluid overload and the increased production of renin.

(4) Anemia - below normal concentration of hemoglobin in the blood for the patient's age and sex. This condition occurs when the kidneys cannot produce the hormone to activate the production of red bone marrow cells.

(5) Uremia - if levels of nitrogen waste products in the blood are very high, urea can be changed into ammonia in the stomach and intestine, causing ulcerations and bleeding.

c. **Treatment of Chronic Renal Failure.** There are three basic elements in the goal of medical management of a patient with chronic renal failure. First, maintain the patient's normal body fluid volume and electrolyte balance. Second, reduce the breakdown of tissue in the patient's body. And, third, try to prevent infection until healing occurs. To accomplish all this, a variety of measures are used, including restricting the patient's fluids to 400 ml per day for the average adult. Also included in the management plan are the following:

(1) Adjustment of the patient's diet to limit the sources of nitrogen, potassium, phosphate, and sulfate.

(2) Vigorous treatment of infection with antibiotics.

(3) Treatment of anemia with a transfusion of a small volume of packed, fresh red blood cells.

3-11. RENAL TUMORS

Tumors of the kidneys usually grow rather slowly. Occasionally, rapidly invading types of tumors are found. Signs of a renal tumor include blood in the urine and dull pain in the kidney region. Immediate surgery may be necessary to save the patient's life.

3-12. POLYCYSTIC KIDNEY

Polycystic kidney disease is an inherited disorder. The disease runs in families. As the name suggests, multiple, bilateral, grapelike clusters of cysts filled with fluid grow in the kidneys. These cysts cause the kidneys to enlarge, compress the kidney tissue, and finally squeeze functioning kidney tissue so that it cannot function any longer. The disease may progress slowly in adults. While polycystic kidney disease cannot be cured, life may be prolonged if associated urinary tract infections and secondary hypertension are controlled.

3-13. RENAL CALCULI (KIDNEY STONES)

Renal calculi, more commonly known as kidney stones, are another disorder of the genitourinary system. Substances such as calcium oxalate, calcium phosphate, magnesium ammonium phosphate sometimes separate from the rest of the urine solution and form a solid deposit. These formations can occur anywhere in the urinary tract, but they usually develop in the renal pelvis or the calyces of the kidneys. There may be one kidney stone or several. The size of the stones vary. Kidney stones develop in Americans in the ration of 1 to 1,000 people. More common in men than women, and rare in children and Blacks, renal calculi occur more frequently in people who live in certain geographic areas: for instance, the Southeastern part of the United States. The reason may be that the hot climate causes the people to become dehydrated, or perhaps the cause is the diet of people in that part of the United States.

a. **Etiology of Renal Calculi.** The exact cause of kidney stones is unknown, but predisposing factors include the following:

(1) Dehydration. Production of smaller amounts of urine promotes kidney stones. Less liquid concentrates calculus-forming substances.

(2) Infection. Clumps of bacteria, particularly when stasis or obstruction accompanies infection, can serve as a nucleus for calculus formation. Additionally, infected and damaged tissue serves as a site for calculus development.

(3) Obstruction. Components of calculus can collect and adhere, forming calculi (stones) in a patient with urinary stasis; for example, an immobile person with a spinal cord injury. An obstruction also promotes infection with an even greater chance of calculus formation.

(4) Metabolic factors. Certain metabolic factors may predispose the formation of calculi. Included are hyperparathyroidism, renal tubular acidosis, elevated uric acid (usually with gout), defective metabolism of oxalate, genetic defect in the metabolism of cystine, and excessive intake of vitamin D or dietary calcium. Excessive intake of milk and cheese products can result in too much dietary calcium.

b. **Signs and Symptoms of Renal Calculi.** The signs and symptoms vary with the size, location, and cause of the calculi. Included are the following:

(1) Pain, the key symptom, will be excruciating and intermittent, usually originating in the flank and radiating across the abdomen, and along the course of the ureters into that area of the groin. A stone in the kidney will cause a dull ache in the flanks with pain extending along the rib margin toward the umbilicus. A stone in the ureter causes pain to radiate from the costovertebral angle down the course of the ureter to the scrotum, or vulva to the inner thighs. A stone in the bladder causes pain to radiate to the distal urethra. This pain accompanies micturition (urination).

(2) Chills, fever, and frequent urination are common.

(3) Hematuria, the discharge of red blood cells in the urine, is common.

(4) Pyuria, with or without bacteria, may be present. Pyuria is the presence of pus in the urine.

(5) As a ureter stone is passed into the bladder, the patient will exhibit a stab of pain followed by instant relief. If the stone is passed with urine, it is necessary to attempt to retrieve it so that it may be analyzed.

c. **Treatment of Renal Calculi.** Treatment usually consists of measures to cause renal calculi to pass through and out of the system naturally since 90 percent of these stones are five millimeters in diameter. Additional treatment includes the following:

(1) Hydration - encourage the patient to drink plenty of fluids.

(2) Pain control - give meperidine (Demerol®) or morphine.

(3) DO NOT give antispasmodics.

(4) Bedrest and supportive treatment.

NOTE: If the calculi are too large to pass through the system naturally, it may be necessary to remove then surgically.

(5) Dietary information - a patient should be taught and urged to follow a diet which will prevent the formation of renal calculi in the future.

Section III. MANAGEMENT OF KIDNEY DISEASES

3-14. DIALYSIS

a. **General Information.**

(1) Properly functioning kidneys are vital to life. Remember the main functions of the kidneys: maintenance of electrolyte and water balance and excretion of waste products. If the kidneys do not function properly, waste products (such as excess minerals, urea, toxins, and drugs) start to accumulate in the body. These waste products must be removed for the person to continue to live. Dialysis is a technique used to remove waste products from the blood and excess fluids from the body when the kidneys are not functioning normally.

(2) Dialysis is the diffusion of dissolved molecules through a semipermeable membrane. These molecules tend to pass from an area of greater concentration to an area of less concentration. In patients who have defective kidney function, the accumulation of urea and other nitrogen waste products can be reduced by passing the patient's blood through a dialysis machine. Thus, dialysis removes waste products from the bloodstream and restores the patient's electrolyte balance. Dialysis cannot cure renal failure, but dialysis can accomplish some of the renal functions so that the patient continues to live. A patient on dialysis uses either a machine with a semipermeable filtering membrane, or his own peritoneal membrane to cleanse his blood.

b. **Methods of Dialysis.** Two methods of dialysis presently in use are hemodialysis and peritoneal dialysis. Both methods are based on the principle of diffusion of dissolved molecules through a semipermeable membrane.

(1) Hemodialysis. In this method, a sheet of cellophane functions as the semipermeable membrane in the dialyzer machine. A patient using this method must usually have dialysis two or three times a week. The process is as follows:

(a) Blood leaves the body through an artery.

(b) This arterial blood passes through the machine's blood pump.

(c) Blood is filtered to remove any clots.

(d) Blood passes through the dialyzer machine.

(e) The blood passes into the venous blood line.

(f) Blood is filtered again to remove any clots.

(g) The blood then flows through an air detector.

(h) Finally, the blood returns to the patient through the venous blood line.

(2) Peritoneal dialysis. In this method of dialysis, the peritoneum acts as the filtering membrane. Dialyzing fluid is introduced into the peritoneal cavity at intervals. The peritoneum is a large surface area and acts as the diffusing membrane filtering the blood in the peritoneal blood vessels. The dialyzing solution remains in the peritoneal cavity for 15 to 30 minutes. Then the solution is allowed to drain out. The severity of the patient's condition determines the length of time the dialysis process takes. Time varies from 12 to 36 hours. Those patients with chronic renal disease can learn how to do their own dialysis treatments at home. This permits patients to resume most of their normal activities.

3-15. KIDNEY TRANSPLANTS

A possible solution for a patient with very limited renal function is to have a healthy kidney transplanted into his body. Many hundreds of kidney transplants have been performed successfully during the last several years. The transplant kidney must be from a donor whose tissue is compatible with the patient's tissue. Records show that the likelihood that a transplant will be successful is greatest when a living donor who is closely related to the patient is used. However, organs from deceased donors have proven satisfactory in many cases. The problem of the patient's body rejecting the transplanted kidney is still a major difficulty. Extensive tissue cross-matching is done, and immune-supressing drugs are used to try to avoid problems with the transplanted kidney. If the patient's body rejects the transplanted kidney, he will have to return to dialysis therapy.

NOTE: Individuals can usually do well with only one kidney. The reason is that the kidneys have a great deal of extra functioning tissue.

Section IV. DISORDERS OF THE URETERS

3-16. URETER ABNORMALITIES/OBSTRUCTIONS

Abnormalities in structure of the ureter include double portions at the kidney pelvis and constricted or abnormally narrow parts called strictures. Narrowing of the ureter, another abnormality, may be caused by abnormal pressure from tumors or other masses outside the ureter. Ureters may be obstructed by stones from the kidneys. If a small stone moves through the ureter, the patient will experience excruciating pain. Ptosis of the kidney (the kidney dropping) can cause the ureter tube to kink.

3-17. TREATMENT OF STONES IN THE URETERS

a. **Early Treatment.** Early treatment for stones in the ureters was by "barber surgeons" who removed stones in the ureters, operating without anesthesia. These surgeons cut through the patient's skin and muscles of the back to remove stones from the ureters. Termed "cutting for stone," this method was relatively successful even though there was no sterile technique. The reason was because by approaching the stones through the back, the peritoneal cavity was avoided, thus reducing the risk of deadly peritonitis.

b. **Present Day Treatment.** Modern surgery uses a variety of instruments for removal of stones from the ureter, including endoscopes. Stones in the ureter are removed by the transurethral route. That is, removal is through the urethra and the urinary bladder from the ureter. Entrance through the skin and muscles of the back may be used to remove calculi from the kidney pelvis or from a ureter.

Section V. DISORDERS INVOLVING THE BLADDER

3-18. GENERAL INFORMATION

a. Injury to the bladder is uncommon; nevertheless, it may occur. A full bladder lies in an unprotected position in the lower abdomen. A blow to the lower abdomen can rupture the bladder, making immediate surgical repair necessary. Such injury typically occurs in traffic accidents.

b. Another type of injury that may cause bladder disorders is injury to the spinal cord. Injury to the spinal cord may severely disrupt bladder filling and emptying. The most common causes of such injuries are motorcycle accidents, automobile accidents, and bullet wounds. If the nerves controlling the bladder are damaged in such injuries, the result may be either incontinence or urinary retention.

3-19. CYSTITIS

a. **Definition/Signs/Symptoms of Cystitis.** Inflammation of the bladder, called cystitis, is ten times as frequent in women as in men. Part of the reason may be that the female urethra is very short compared to the urethra of the male. Bacteria (for example, colon bacilli) ascend from the outside through the urethra into the bladder causing cystitis. The most common symptoms of cystitis are pain, urgency (a feeling of needing to void although the bladder is not full), and frequency of urination.

b. **Interstitial Cystitis.** Interstitial cystitis is a type of cystitis in which the tissues below the mucosa are inflamed. Symptoms include pelvic pain with discomfort before and after urination. This disease can be diagnosed only with the use of a cystoscope (a kind of endoscope).

c. **Etiology of Cystitis.** Causes of cystitis can be traced to the following:

(1) Bladder infection caused by the infecting organism ascending through the urethra. Such infections are more common in females, especially after intercourse. In males, cystitis is less common than prostatis and urethritis.

(2) Trauma from catheters, stones, or instrumentation.

(3) Inadequate bladder emptying (urinary retention, dehydration, or outlet obstruction).

d. **Signs and Symptoms of Cystitis.** Included are the following:

(1) Frequent, burning, urgency to urinate even when the bladder is not full.

(2) Cloudy urine caused by the presence of bacteria in the urine.

(3) With a severe infection, chills, fever, nausea, vomiting, and abdominal or low back pain.

(4) Occasionally, no symptoms at all.

e. **Treatment of Cystitis.** Included are the following:

(1) Urinalysis with culture and sensitivity test, if available.

(2) Systemic treatment with antibacterials such as Macrodantin® and Mandelamine®.

(3) Application of heat locally.

(4) Analgesics and antispasmodics for spasms of smooth muscles of the urinary tract.

NOTE: Cystitis (as well as diabetes) may develop in a person whose resistance to infection is low. The danger in cystitis is that this infection may ascend to other parts of the urinary tract.

3-20. TUMORS OF THE BLADDER

a. **Etiology of Tumors of the Bladder.** The most prevalent tumors in males over 50 are bladder tumors. They are more common than benign papillomas and various kinds of cancer. About 90 percent of bladder tumors arise from the epithelial lining. Possible causes include:

(1) Toxins, particularly certain aniline dyes. (Many aniline dyes are obtained from coal tar.)

(2) Chronic infestations of schistosomes (blood flukes) in the bladder.

(3) Heavy cigarette smoking.

(4) The presence of urinary stones. These may develop and increase in size within the bladder.

b. **Signs and Symptoms of Tumors of the Bladder.** Included are the following:

(1) Hematuria (discharge of red blood cells in the urine) is the most common symptom, occurring early in the tumor's growth.

(2) Cystitis with frequency, urgency, and pain on urination.

(3) Pain above the pubic arch, occurring as the tumor extends beyond the bladder.

c. **Treatment of Tumors of the Bladder.** Cystoscopic examination and biopsies should be done as soon as blood is detected in the urine. Removal of the tumor before it invades the muscle wall gives the best prognosis.

Section VI. DISORDERS OF THE URETHRA

3-21. CONGENITAL DEFECTS

A variety of congenital defects present at birth may involve the urethra as well as other parts of the urinary tract.

a. The opening of the urethra to the outside may be too small or the urethra itself may be narrowed.

b. Occasionally, an abnormal valve-like structure is located at the point at which the urethra enters the bladder. If this structure is not removed surgically, these valve-like folds of tissue can cause a backpressure of the urine with serious consequences.

c. Occasionally, an abnormal valve-like structure is located at the point at which the urethra enters the bladder. If this structure is not removed surgically, these valve-like folds of tissue can cause a backpressure of the urine with serious consequences.

3-22. OTHER DISORDERS

Other disorders to the urethra include:

a. **Urethritis.** Urethritis is the inflammation of the mucous membrane and the glands of the urethra. This disorder is more common in males than in females. Signs and symptoms include burning pain on urination, frequent urination, and pain in the lower abdominal area. Urine may be cloudy, foul smelling, or dark. Urethritis is often caused by gonorrhea, although other bacteria may also be responsible for the infection.

b. **"Straddle Injuries."** These injuries to the urethra are common in men. The urethra is caught between a hard surface and the pubic arch. This may result in rupture of the urethra.

c. **Trauma.** In accidents in which the bones of the pelvis are fractured, rupture of the urethra is fairly common. The male urethra, especially, is easily injured in accidents. In these cases, surgical repair of the urethra may be necessary.

Section VII. INJURIES TO ORGANS OF THE GENITOURINARY SYSTEM

3-23. GENERAL INFORMATION

Injuries to the organs of the genitourinary system can be caused by penetrating or perforating wounds, blunt crushing accidents, and surgery. To preserve renal function, it is very important that these injuries are diagnosed and treated promptly.

3-24. KIDNEY INJURIES

Kidney injuries can be caused by bleeding from the renal vein or arteries. The initial cause of the bleeding may have been a blunt injury to the flank.

a. **Specific Causes/Signs/Symptoms of Kidney Injuries.** Included are the following:

(1) Wounds to the lower back in the flanks (flank = side of the body between the ribs and the pelvis).

(2) A history of blows to the flank, hard enough to cause pain.

(3) Hematuria (discharge of red blood cells in the urine) or ecchymosis (bruises) of the flank.

b. **Treatment for Kidney Injuries.** Follow this procedure:

(1) Start an IV.

(2) Treat the patient for shock.

(3) Obtain baseline kidney laboratory data such as a complete blood count (CBC differential), urinalysis, urinalysis blood urea nitrogen (BUN) lytes, and urine lytes.

3-25. BLADDER INJURIES

Bladder injuries may be caused by blunt or penetrating trauma such as seat belt injury or fractured pelvis.

a. **Signs and Symptoms of Bladder Injuries.** Included are the following:

(1) Hematuria (discharge of red blood cells in the urine).

(2) Ecchymosis (bruise) around the pubis or across the lower abdomen.

b. **Treatment for Bladder Injuries.** The treatment for bladder injuries is based on having the bladder rest. The bladder can rest if:

(1) Catheter drainage is performed.

(2) Shock is treated, if indicated.

(3) Surgical repair is done, if necessary.

(4) Other conditions are treated; for example, a fractured pelvis is splinted or surgically treated.

3-26. URETHRAL INJURY

The cause of urethral injury can be traced to pelvic fracture and penetrating wounds to the groin.

a. **Signs and Symptoms of Urethral Injury.** Included are the following:

(1) Hematuria.

(2) Escape of urine and blood into the surrounding tissues in the lower groin.

b. **Treatment of Urethral Injury.** Treat as follows:

(1) Attempt to insert a Foley catheter without forcing.

(2) Treat any wounds of the external genitalia.

Section VIII. DRUG THERAPY FOR GENITOURINARY DISEASE/DISORDERS

3-27. DRUG THERAPY

A number of medications can be given to treat genitourinary system diseases and disorders. Information about some of these medications is given here. The medications are sulfisoxazole, trimethoprim, cotrimoxazole sulfamethoxazole, ampicillin, tetracycline, nitroufurantoin, methenamine mandelate, and phenazopyridine.

3-28. SULFISOXAZOLE (GANTRISIN®)

Sulfisoxazole is an antibacterial agent used in drug therapy for genitourinary disease and disorders. Sulfonamides are very effective in treating a wide variety of first-time infections. The dosage for sulfisoxazole is a loading dose of gm by mouth, followed by 1-2 gm by mouth four times a day for a period of 10 to 14 days.

a. **Adverse Reactions to Sulfisoxazole.** Included are the following:

(1) Nausea and vomiting.

(2) Pain, arthralgia, joint pain.

(3) Crystalluria (presence of crystals in the urine).

(4) Renal damage.

(5) Liver damage.

(6) Serious blood dyscrasias (general morbid condition of the blood).

b. **Contraindications for Sulfisoxazole.** Generally, sulfonamides are contraindicated for recurrent and chronic urinary tract infections. These drugs are not recommended for long-time use because they alter fecal flora thus increasing the risk of resistant infection. Sulfonamides should be avoided in the following patients:

(1) Pregnant women at term and nursing mothers. (This drug passes through the placenta and is excreted in the milk.)

(2) Individuals with impaired renal or hepatic function.

(3) Patients with hemolytic anemia (anemia from abnormal destruction of red blood cells in the body).

(4) Individuals hypersensitive to sulfonamides.

NOTE: When sulfonamides are used, it is necessary for the patient to maintain an adequate fluid intake in order to avoid crystalluria (the presence of crystals in the urine).

3-29. TRIMETHOPRIM AND COTRIMOXAZOLE SULFAMETHOXAZOLE (BACTRIM®, SEPTRA®)

Either of these medications may be indicated for the treatment of chronic urinary tract infections evidenced by persistent bacteria, frequent recurrent infections or infections associated with urinary tract complications such as obstruction. The dosage of trimethroprim and cotrimoxazole is 800 mg twice a day for 10 to 14 days. DO NOT USE these medications with patients with hepatic and renal dysfunction if the patients have adverse reactions to these medications. Contraindications are the same as for the medication Gantrisin® (paragraph 3-28a).

3-30. AMPICILLIN (PENBRITIN®, POLYCILLIN®, OMNIPEN®)

These are clinically indicated, broad-spectrum antibiotics that are effective in treating genitourinary infections. The dosage of an ampicillin drug is 25 to 500 mg every six hours for 10 to 14 days. Adverse reactions to ampicillin are limited to sensitivity phenomena. The contraindications of this drug are those known individuals who are sensitive to penicillin.

3-31. TETRACYCLINE (CYCLOPAR®)

This broad-spectrum antibiotic is effective against gram-positive and negative bacteria, certain mycoplasma, rickettsiae, and protozoa. The dosage is 250 mg by mouth every six hours for 10 to 14 days.

a. **Adverse Reactions to Tetracycline.** Adverse reactions to this drug include the following:

(1) Gastrointestinal disturbance.

(2) Skin rash.

(3) Renal toxicity.

(4) Hypersensitivity to the drug.

b. **Contraindications to Tetracycline.** Contraindications are those known to patients who have tetracycline hypersensitivity. Use of this drug should be watched during pregnancy. The drug may cause discoloration of the teeth, enamel hypoplasia (failure of the enamel of the teeth to develop completely), and bone growth inhibition.

3-32. NITROUFURANTOIN (MACRODANTIN®)

This drug, a synthetic antibacterial agent, is used as a short-time preventive measure and also in long-term suppressive therapy for individuals with chronic urinary tract infections. The dosage of this drug is 5 to 100 mg four times a day for a three-day period. After this period, the urine is sterile. This medication is a urinary antiseptic. That is, nitroufurantoin is an agent that kills or prevents the growth of microorganisms when applied to living tissue.

a. **Possible Adverse Reactions.** Included are the following:

(1) Gastric disturbances. The patient may experience nausea, vomiting, and diarrhea. To lower gastric irritation, give the medication with milk. The severity of the reaction is related to the strength of the medication dose.

(2) Hypersensitivity reactions. The patient may experience pulmonary pneumonitis. Signs and symptoms of this condition may disappear when the drug is discontinued.

b. **Contraindications to Nitrofurantoin.** Included are the following:

(1) Anuria (patient of average adult size voids less than 100 ml of urine daily).

(2) Oliguria.

(3) Renal impairment.

(4) Pregnancy.

(5) Infants of less than one month.

(6) Known sensitivity to nitrofurantoin.

3-33. METHENAMINE MANDELATE (MANDELAMINE®)

This drug is clinically indicated as a prophylactic and suppressive treatment of bacteriuria via urine acidification. The dosage of this drug is 1 gm four times a day for three days after the urine is sterile. Adverse reactions to the drug include the following:

a. Mild gastric irritation.

b. Inflammation of the urinary tract in higher doses.

c. Hypersensitivity reaction such as a rash.

NOTE: DO NOT give this drug to a patient is who is taking Bactrim® or Septra®. Methenamine works best in an acidic urine. If sulfonamides are administered at the same time, a precipitate will form caused by the basic nature of the sulfonamides.

3-34. PHENAZOPYRIDINE (PYRIDIUM®)

Phenazopyridine is an analgesic (an agent to relieve pain). This medication is clinically indicated for pain associated with urinary tract irritation or infection. The medication is excreted in the urine where it acts as a local anesthetic on mucosa. This drug helps relieve the patient of pain and burning during urination. Also relieved is the patient's feeling of needing to urinate too frequently and urgently. The recommended dosage for adults is 100 to 200 mg by mouth four times a day after meals for three days, if the pain is relieved. The drug may alter clinistix or Tes-tape results. Clinitest tabs must be used if urinalysis is needed. Adverse reactions to this medication include:

a. Headache.

b. Rash.

c. Pruritus.

d. Occasional gastrointestinal disturbances.

e. Staining of contact lenses has been reported.

f. At overdose levels, hemolytic anemia (anemia from abnormal destruction of red blood cells in the body) and renal and hepatic toxicity.

NOTE: Warn patients that this drug will color the urine red to orange and can stain fabrics.

Section IX. THE EFFECTS OF AGING

3-35. GENERAL INFORMATION

A number of biologic changes that are influenced by hereditary and environmental factors occur in the aging. Some changes are physiologic, changes that occur because of normal wear and tear over the years. Other changes are the result of disease or the person's life-style. It is important to remember that each individual ages in his own unique way. This accounts for the wide variation of changes in the aging population.

3-36. GENITOURINARY SYSTEM CHANGES

A number of changes in the genitourinary system occur as the body ages. Look at these changes.

a. Even without kidney disease, aging causes the kidneys to lose some of their ability to concentrate urine. With aging, progressively more water is needed to excrete the same amount of waste. Therefore, it is necessary for older persons to drink more water than young people. Older people eliminate larger amounts of urine (polyuria) even at night (nocturia).

b. Beginning at about age 40, there is a decrease in the number and size of the nephrons. Often, more than 50 percent of the nephrons are lost before age 80.

c. There may be an increase in blood urea nitrogen (BUN) without serious symptoms.

d. The elderly are more susceptible than young people to infections of the urinary system.

e. Childbearing may have caused damage to the musculature of the pelvic floor. Years later, this damage may cause urinary tract problems.

f. Enlargement of the prostate, common in older men, may cause obstruction and back pressure in the ureters and kidneys. If an enlarged prostate condition is untreated, it will cause permanent damage to the kidneys.

g. Age changes may predispose a person to incontinence, but age changes do not cause a person to be incontinent. Most elderly persons (60 percent of those residing in nursing homes and up to 90 percent of those living independently) have no incontinence.

3-37. CLOSING

All the systems of the body are important. The body has developed the ability to protect itself by being able to compensate and function well with only one kidney. Looking at that compensatory mechanism, it is even more devastating when kidney failure occurs, and the person must rely on dialysis. Early awareness of such problems can eliminate or prevent many diseases, which attack the kidneys. An individual can survive without a bladder, but the quality of life will be drastically changed. Use your assessment skills to obtain early treatment for diseases of the genitourinary system, preventing those diseases from progressing to more serious levels.

Continue with Exercises

EXERCISES, LESSON 3

INSTRUCTIONS. Answer the following exercises by writing the answer in the space provided.

After you have completed all of these exercises, turn to "Solutions to Exercises" at the end of the lesson and check your answers. For each exercise answered incorrectly, reread the material referenced with the solution.

1. Urinary tract infections are caused by _____.

   They are located anywhere between the _____

   and the _____.

2. List four factors that predispose an individual to urinary tract infections.

   a. _____.

   b. _____.

   c. _____.

   d. _____.

3. The term neurogenic bladder is used to refer to any _____

   _____.

4. The primary symptom of a urinary tract infection is _____.

5. Laboratory analysis of urine indicates the following:

   a. Pale urine indicates _____.

   b. Greenish urine indicates _____,

   c. Brown-black urine indicates _____

      or _____.

6. Glomerulonephritis is an inflammation of the kidneys in which antibodies formed in response to streptococci attach themselves to the

   _____.

7. List three signs/symptoms of acute glomerulonephritis.

   a. _____.

   b. _____.

   c. _____.

8. Pyelonephritis is an inflammation of the _____

   _____.

9. List four groups of people in which the incidence of acute pyelonephritis is high.

   a. _____.

   b. _____.

   c. _____.

   d. _____.

10. A patient with acute pyelonephritis should encouraged to achieve a urinary output of more than _____.

11. Hydronephrosis is _____

    _____

    caused by _____

    _____.

12. The treatment for hydronephrosis is _____

_____.

13. List three types of acute renal failure and their causes.

a. _____

_____.

b. _____

_____.

c. _____

_____.

14. The three basic elements in the goal of medical management of a patient with chronic renal failure are:

a. _____.

b. _____.

c. _____.

15. List two signs/symptoms of renal tumors.

a. _____.

b. _____.

16. Polycystic kidney is an inherited kidney disorder. What occurs?

_____.

17. Another name for renal calculi is _____.

18. Possible causes of renal calculi Infection are obstruction, metabolic factors, and

_____

19. List three signs and symptoms of renal calculi.

a. _____.

b. _____.

c. _____.

20. Dialysis is diffusion of dissolved molecules through a

_____.

21. What does dialysis do? _____

_____.

22. List two methods of dialysis.

a. _____.

b. _____.

23. Cystitis is an _____

_____.

24. Tumors of the bladder are most common in males over the age of _____.

25. Two signs/symptoms of cystitis are:

a. _____.

b. _____.

26. List four causes of tumors of the bladder.

    a. _____.

    b. _____.

    c. _____.

    d. _____.

27. "Straddle injuries," common in men, are caused by _____

    _____.

28. List two signs/symptoms of kidney injuries.

    a. _____.

    b. _____.

29. The basic treatment for bladder injuries is to _____

    _____.

30. List two possible causes of urethral injury.

    a. _____.

    b. _____.

31. Pregnant women at term should not be given Sulfisoxazole, a medication effective in treating genitourinary disease, because _____

    _____.

32. Tetracycline, a broad-spectrum antibiotic, may have a negative effect on teeth. List two effects.

a. _____.

b. _____.

33. Phenazopyridine, an analgesic, can have an effect on contact lenses.

What is that effect? _____

_____.

34. Why should older people drink more water than young people?

_____

_____

_____.

Check Your Answers on Next Page

SOLUTIONS TO EXERCISES, LESSON 3

1. Infectious organisms.
   Kidneys.
   Urethral opening. (para 3-2a)

2. Sex of the individual (females are at greater risk for UTIs).
   Urinary stasis.
   Instrumentation.
   Neurogenic bladder. (para 3-2b(1) - (4))

3. Disturbance of the bladder function caused by impairment of the nerve supply. (para 3-2b(4))

4. Pain. (para 3-3)

5. a. Diabetes insipidus.
   b. Bile pigment, which is associated with jaundice.
   c. Poisoning or hemorrhage. (para 3-4a(6))

6. Glomerular membrane and injure this membrane. (para 3-6)

7. You are correct if you listed any three of the following:
   Hypertension.
   Edema.
   Hematuria.
   Albuminuria.
   Oliguria. (para 3-6b(1) - (5))

8. Kidney pelvis and the tissue of the kidney itself. (para 3-7)

9. Pregnant women.
   Sexually active women.
   Diabetic individuals.
   Individuals with other renal diseases. (para 3-7a(2)(a) - (d))

10. 2,000 ml per day. (para 3-7a(4)(c))

11. Distention of the renal pelvis and calyces
    An accumulation of urine caused by an obstruction to the normal urine flow. (para 3-8)

12. Surgical removal of the obstruction. (para 3-8c)

13. Prerenal failure is caused by diminished blood flow to the kidneys.

    Intrinsic (parenchymal) renal failure is caused by damage to the kidneys themselves, the damage usually resulting from acute tubular necrosis.

    Postrenal failure is caused by obstruction of urinary flow bilaterally. (para 3-9a(1) - (3))

14. Maintain the patient's normal body fluid volume and electrolyte balance.
    Reduce the breakdown of tissue in the patient's body.
    Try to prevent infection until healing occurs. (para 3-10c)

15. Blood in the urine.
    Dull pain in the kidney region. (para 3 - 11)

16. Multiple, bilateral, grapelike clusters of cysts filled with fluid grow in the kidneys. (para 3-12)

17. Kidney stones. (para 3-13)

18. Dehydration. (para 3-13a(1)

19. You are correct if you listed any three of the following:
    Pain.
    Pyuria.
    Chills, fever, and frequent urination are common.
    Hematuria.
    Stab of pain followed by instant relief. (para 3-13b(1) - (5))

20. Semipermeable membrane. (para 3-14)

21. Dialysis removes waste products from the patient's bloodstream and restores the patient's electrolyte balance. Basically, dialysis cleanses the patient's blood. (para 3-14a(2))

22. Hemodialysis.
    Peritoneal dialysis. (para 3-14b(1), (2))

23. Inflammation of the bladder that is ten times as frequent in women as in men. (para 3-19a)

24. 50. (para 3-20a)

25. You are correct if you listed any two of the following:
Frequent burning urgency to urinate (although the bladder is not full).
Chills
Nausea.
Fever.
Vomiting.
Abdominal pain.
Low back pain.
Cloudy urine.
Occasionally, no symptoms at all. (para 3-19d(1) - (4))

26. Toxins.
Chronic infestations of schistosomes (blood flukes) in the bladder.
Heavy cigarette smoking.
Presence of urinary stones. (para 3-20a(1) - (3))

27. The urethra being caught between a hard surface and the pubic arch. (para 3-22b)

28. You are correct if you listed any two of the following:
Wounds to the lower back in the flanks
A history of blows to the flank, hard enough to cause pain.
Hematuria.
Ecchymosis. (para 3-24a(2) - (3))

29. Have the bladder rest. (para 3-25b)

30. Pelvic fracture.
Penetrating wound to the groin. (para 3-26)

31. This drug passes through the placenta to the fetus. (para 3-28b(1))

32. You are correct if you listed any two of the following:
Discoloration of teeth.
Enamel hypoplasia (failure of the enamel of the teeth to develop completely).
Bone growth inhibition. (para 3-31b)

33. Phenazopyridine can stain contact lenses. (para 3-34e)

34. With aging, progressively more water is needed to excrete the same amount of waste. Therefore, it is necessary for older persons to drink more water than young people. Older people eliminate larger amounts of urine (polyuria) even at night (nocturia). (para 3-36a)

End of Lesson 3

LESSON ASSIGNMENT

LESSON 4	Urinary System Diseases/Disorders
LESSON ASSIGNMENT	Paragraphs 4-1 through 4-8.
LESSON OBJECTIVES	After completing this lesson, you should be able to:
	4-1. Identify the purposes of and indications for urinary catheterization.
	4-2. Identify the procedures for performing a urinary catheterization.
	4-3. Identify the proper procedures for maintaining surgical aseptic technique.
SUGGESTION	After completing the assignment, complete the exercises at the end of this lesson. These exercises will help you to achieve the lesson objectives.

LESSON 4

URINARY CATHETERIZATION

4-1. INTRODUCTION

Sometimes the homeostasis of the urinary system becomes upset, making the normal function of micturition impossible. There may be a need then for catheterization. Health care providers must strive to make this a safe, efficient, and non-traumatic experience for the patient.

4-2. PURPOSES OF CATHETERIZATION

There are a number of reasons why catheterization may be performed. Included are the following:

a. Obtain a sterile urine specimen.

b. Measure the amount of residual urine in the bladder.

c. Relieve a distended bladder in the patient who is unable to void.

d. Provide continuous drainage or irrigation.

e. Administer medications such as a chemotherapeutic solution.

f. Measure the urinary output.

g. Prepare a patient for a surgical procedure or obstetrical delivery (childbirth).

h. Assist the patient following surgery.

4-3. INDICATIONS FOR CATHETERIZATION

Indications for catheterization include the following:

a. The patient's bladder is severely distended.

b. Urinary output is severely decreased.

c. There is a significant outflow obstruction.

d. The patient is in shock or pre-shock status.

e. The patient has an acute spinal cord injury.

4-4. GENERAL PRECAUTIONS

Because both the bladder and the urethra are easily injured and highly susceptible to infection, it is important to remember several precautions in the performance of this procedure.

a. **Aseptic Technique.** Aseptic technique is essential. Each catheterization is a potential source of infection if not carried out properly. Most cases of cystitis that develop after catheterization are caused by improper catheterization technique. Cystitis is difficult to cure and causes increased pain for the patient.

b. **Lubricated Catheter.** The catheter must be well lubricated (unless made of silicone) prior to insertion. Lubrication reduces friction and trauma to the mucous membrane lining of the urethra and the bladder.

c. **Principles of Insertion.** The catheter is inserted only far enough to enter the bladder. Since the adult male urethra is usually about six inches long, it is usually sufficient to insert the catheter about seven inches. The female urethra is about 1 and one half inches long, extending from the bladder to an external opening between the clitoris and the opening of the vagina. A two-inch insertion of the catheter should suffice in the adult female.

d. **Skillful Handling of Equipment.** A medical specialist who is skillful in handling the equipment can avoid trauma to the patient by being gentle. Use only mild pressure. Never force a catheter into place. If more than normal resistance is met, report the difficulty to the doctor. In these cases, which are unusual, dilation (expansion) of the urethra may be necessary.

4-5. CATHETERIZATION PROCEDURE

Follow this procedure.

a. Check the doctor's orders.

b. Gather equipment. Assemble this equipment:

(1) Catheter, in the appropriate size (the size you ordered).

(2) Drainage bag.

(3) Sterile gloves.

(4) Water soluble lubricant.

(5) Cleansing agent.

(6) Cotton balls or sterile 4 inch by 4 inch pads.

NOTE: Cotton balls or 4 by 4-inch pads soaked in a cleansing agent can be used as antiseptic wipes.

(7) Forceps.

(8) Nonallergic tap.

(9) Sterile solution to inflate balloon.

(10) Sterile specimen container, if indicated.

(11) Sterile drapes.

(12) Collection basin.

NOTE: If you are using a commercially prepared catheter set, the items shown in figure 4-1 will be in the set.

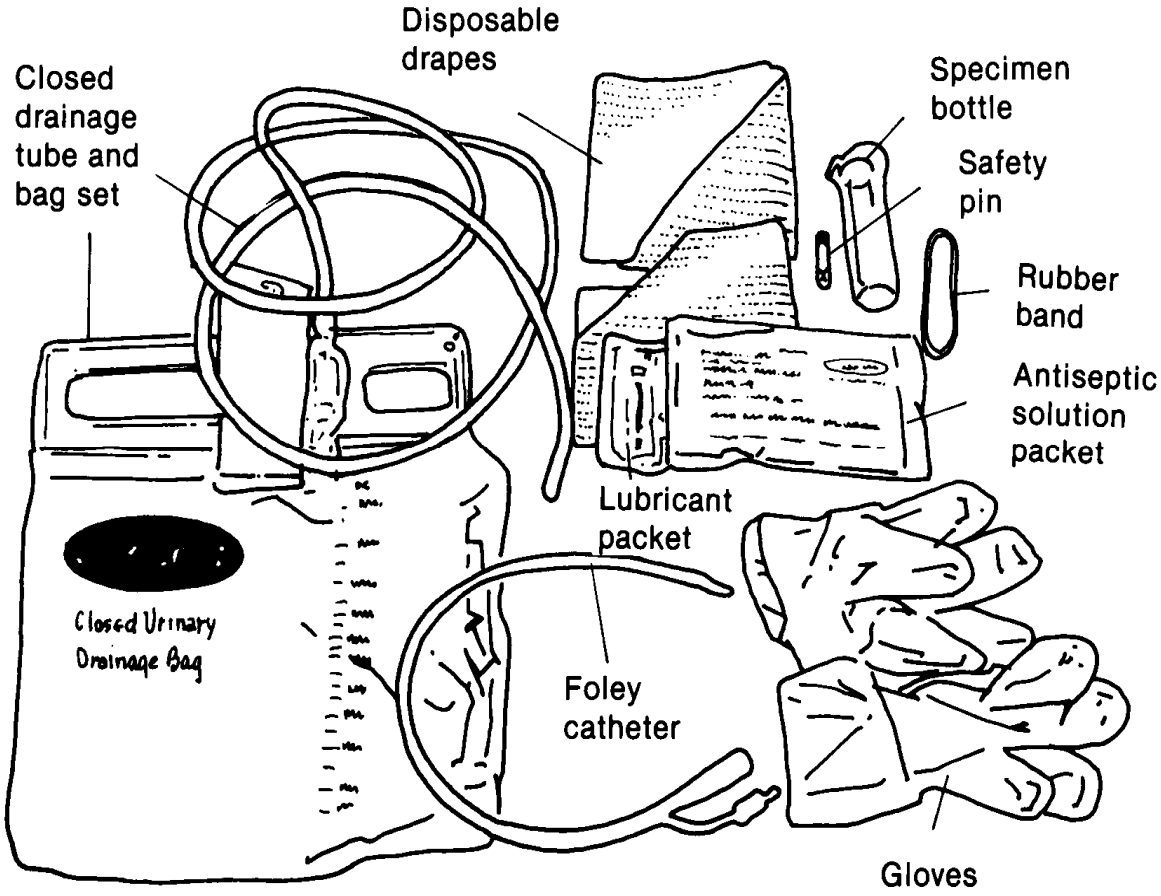

Figure 4-1. Foley catheter set up.

c. Explain the procedure to the patient. This procedure may be embarrassing to the patient and cause him some anxiety. It is, therefore, very important to explain to the patient what you are going to do. Tell the patient that the procedure will not be painful but that he will feel pressure as the catheter is inserted.

d. Provide for the patient's privacy. Provide privacy by drawing curtains around an area or closing a hall door.

e. Wash your hands.

f. Do these pre-performance steps.

(1) Move the patient to the side of the bed nearest you. Raise the bed to working height to avoid back strain while you are working. Lower the side rail, if necessary, on the side where you are working.

(2) Position the patient. Help the patient into the dorsal recumbent position (patient on his back with his lower limbs flexed and rotated outward).

(3) Insertion technique for an indwelling catheter.

(a) Remove the drainage system from the bag.

(b) Attach the bag to the bed frame.

(c) Bring the end of the drainage tubing up between the side rail and the mattress.

(d) Place the end of the drainage tubing so that it is convenient to reach and won't fall off the mattress during the procedure.

NOTE: These steps are not performed when a commercial pack is used.

(4) Open the sterile catheter tray.

(5) Don sterile gloves.

(6) Pick up the plastic-coated drape.

(7) Grasping the drape at the top (with the plastic side away from you), fold the of the drape over your gloved hands to make a cuff.

(8) Place the drape, with the plastic side down, on the bed between the patient's legs. Slip the cuffed edge under the patient's buttocks. Pull your hands out.

(9) If desired, pick up the fenestrated drape and place it over the patient's genitalia.

(10) Place a sterile tray on the sterile drape between the patient's legs.

(11) If you are obtaining a specimen, remove the lid from the specimen container and place the lid on the sterile drape.

(12) Squeeze a small amount of sterile lubricant into the catheter tray.

(13) If you are inserting an indwelling catheter, attach the filled syringe to the lumen valve of the catheter. Check the balloon patency.

(14) Prepare antiseptic cleansing solution.

(15) Cleanse the patient. Cleansing the area properly is very important in order to prevent infection. Urinary catheterization is responsible for a high percentage of nosocomial infections. (Nosocomial infection = infection acquired in a treatment facility.)

(a) Cleansing a female patient.

1 Separate the labia with your nondominant hand.

2 Place the thumb and forefinger between the labia minoria.

3 Separate the labia and pull up.

4 With your dominant hand using the forceps to hand antiseptic wipes, cleanse the far labia from the clitoris toward the anus with the wipe. Discard the used wipe.

5 With another wipe, cleanse the near labia. Discard that used wipe.

6 With another wipe, cleanse down the center directly over the meatus. Discard the used wipe.

7 Throughout the procedure, keep the labia spread.

(b) Cleansing a male patient.

1 Support the penis with your nondominant hand.

2 Using forceps to handle the antiseptic wipes, cleanse the penis in a circular motion from the meatus toward the base of the penis. Discard the used wipe.

3 Repeat this process at least twice.

g. Insert a catheter in a female. See figure 4-2.

(1) Pick up the catheter with your dominant hand. Hold the catheter about three inches from its tip.

(2) Lubricate the tip of the catheter. Keep the remainder of the catheter coiled into the palm of your hand.

(3) Ask the patient to breathe through her mouth.

(4) Gently insert the catheter (downward and toward the back) about two inches or until urine begins to flow. **DO NOT** insert the catheter more than two inches.

(5) Release the labia and hold the catheter securely with your nondominant hand.

(6) If the vagina is inadvertently catheterized, **DO NOT** reuse the catheter. Assemble fresh equipment and attempt the procedure again.

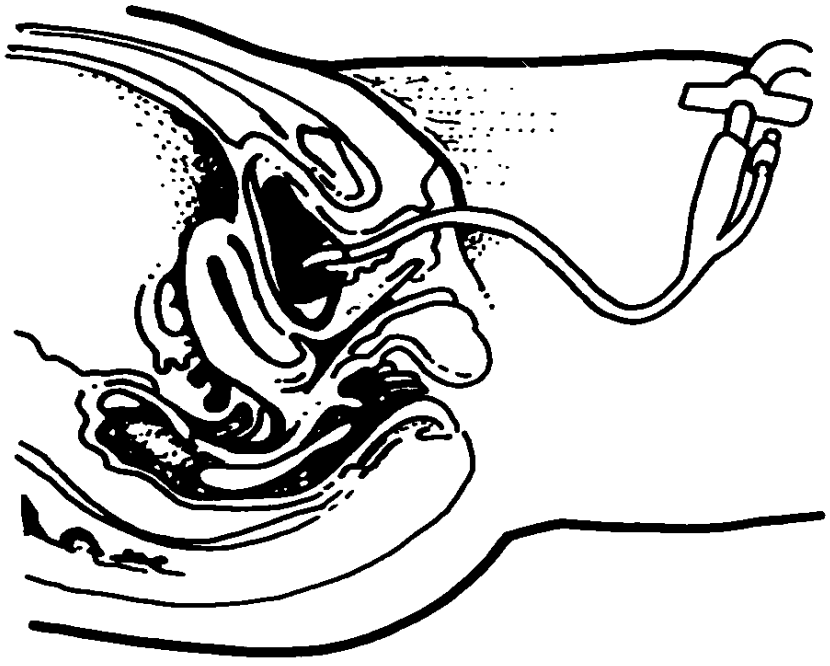

Figure 4-2. Female catheterization.

h. Insert a catheter in a male. Catheterization of a male differs from a female primarily in positioning and cleansing. The tray and equipment are the same. The principles of aseptic technique must be maintained. The preparation of materials to be taken to the patient's bedside are the same. Follow the steps listed in paragraph 4-5a through c with these exceptions: place the patient in a supine position with his legs extended and place a moisture-proof pad across his upper thighs. See figure 4-3. Then follow this procedure.

(1) Pick up the catheter with your dominant hand about three inches from the tip. With your last three fingers, hold the distal end of the catheter in the palm of your hand.

(2) Lubricate the tip of the catheter.

(3) Draw the penis upward and forward at a 60 to 90 degree angle to the patient's legs.

(4) Have the patient breathe through his mouth.

(5) Insert the tip of the catheter into the urethra. Grasp the catheter and gently insert seven to eight inches or until resistance is met.

(6) Gently advance the catheter until urine flows.

(7) Lower the penis and hold the catheter securely with your non-dominant hand. Rest your hand on the patient's pubis for support.

(8) Place the other end of the catheter in the collection basin.

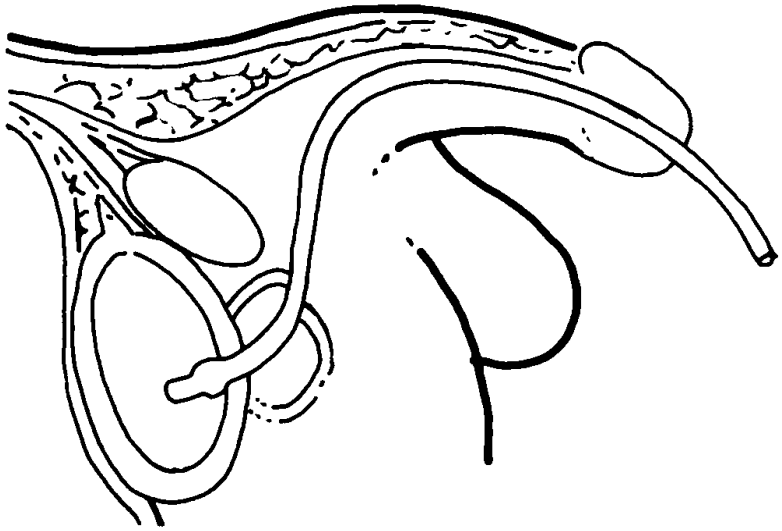

Figure 4-3. Male catheterization.

4-6. OBTAIN A SPECIMEN

If ordered to obtain a specimen, follow this procedure:

a. Place the specimen container in the collection basin.

b. Pinch the catheter with your nondominant hand.

c. Pick up the drainage end of the catheter and hold it over the specimen container.

d. Unclamp your fingers and allow approximately 30 cc of urine to drain into the container.

e. Re-pinch the catheter and place the drainage end into the collection basin.

f. Allow the urine flow to resume.

g. Place the specimen container on the table and replace the lid.

4-7. INDWELLING CATHETER

An indwelling (retention) catheter is ordered to permit continued drainage of the urinary bladder without repeated catheterization. The catheter commonly used is a self-retaining urethral catheter (Foley type). This catheter has a double lumen, with one opening for drainage and the other for inflation of the retention device (a small balloon at the tip of the catheter). After insertion of an indwelling catheter, perform these steps:

a. Inflate the balloon with the proper amount of solution from the syringe.

b. Tug gently on the catheter to make sure the balloon is inflated sufficiently to retain the catheter in place.

c. Attach drainage tubing from the collection system to the catheter without contaminating either. (With a commercially prepared catheterization set, the catheter comes connected to the collection system.)

d. The patient's facial expression is a good indication of whether or not balloon was inflated within the urethra.

4-8. CONCLUDING STEPS OF CATHETERIZATION

a. Remove your gloves.

b. Tape the catheter to the patient. For a female, tape the catheter to the inner aspect of the thigh. For a male, tape the catheter to the abdomen if ordered by the doctor or tape it to the inner thigh.

c. Clean the genital area.

d. Reposition the patient. Be sure the patient is safe and comfortable.

e. Report and record the procedure.

Continue with Exercises

EXERCISES, LESSON 4

INSTRUCTIONS. Answer the following exercises by writing the answer in the space provided.

After you have completed all of these exercises, turn to "Solutions to Exercises" at the end of the lesson and check your answers. For each exercise answered incorrectly, reread the material referenced with the solution.

1. List four purposes of catheterization.

   _____

   _____

   _____

   _____

2. Reducing friction and trauma to the mucous membrane lining of the urethra and the bladder are two reasons to_____ a catheter before insertion.

3. You meet more than normal resistance when inserting a catheter.

   What should you do?

   _____.

4. When you are explaining the catheterization process to a patient, tell him that inserting the catheter will not be _____, but he will feel _____. as the catheter is inserted.

5. The first four steps in the catheterization procedure are to:

   a. Check _____.

   b. Gather _____.

   c. Explain _____.

   d. Provide _____.

6. Catheterization of a male differs from catheterization of a female primarily in two ways. They are _____. and _____.

7. After inserting a Foley catheter (an indwelling catheter), you inflate the _____ to keep the catheter in place.

Check Your Answers on Next Page

SOLUTIONS TO EXERCISES, LESSON 4

1. You are correct if you listed any four of the following:
   Obtain a sterile urine specimen.
   Measure the amount of residual urine in the bladder.
   Relieve a distended bladder in the patient who cannot void.
   Provide continuous drainage or irrigation.
   Administer medications.
   Measure urinary output.
   Prepare a patient for surgery or childbirth.
   Help a patient after surgery. (para 4-2a through h).

2. Lubricate catheter. (para 4-4b)

3. **DO NOT** force the catheter in place. Report the difficulty to a doctor. (para 4-4d)

4. Painful.
   Pressure as the catheter is inserted. (para 4-5c)

5. a. Check the doctor's orders.

   b. Gather equipment.

   c. Explain the procedure to the patient.

   d. Provide for the patient's privacy. (para 4-5a through d)

6. Positioning.
   Cleansing. (para 4-5h)

7. Balloon. (para 4-7)

End of Lesson 4