Medical Terminology

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Lecture Eight

URINARY SYSTEM

Word Elements • The Urinary System

WORD ELEMENT	MEANING	EXAMPLE
cyst/o	bladder	cystitis
glomerul/o	glomerulus	glomerulonephritis
-iasis	suffix meaning "condition" or "state"	nephrolithiasis
lith/o	stone	nephrolithotomy
nephr/o, ren/o	kidney	nephritis, renal
noct/o	night	nocturia
olig/o	little, few	oliguria
poly-	prefix meaning "much" or "many"	polyuria
py/o	pus	pyuria
pyel/o	pelvis	pyelonephritis
ur/o, urin/o	urine	urography
ureter/o	ureter	ureterolith
urethr/o	urethra	urethralgia

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An Overview of the Urinary System

The urinary system is composed of the kidneys , ureters , urinary bladder , and urethra . Figure 13-1 illustrates the location of each of these structures. The primary function of the urinary system is to remove wastes and toxins from the body. The process starts with the kidneys, which remove certain wastes from the bloodstream. The kidneys then convert the waste to urine (water that contains other substances in solution) and transport it to the bladder via the ureters.

The urine is then eliminated through the urethra. This process regulates the amount of water in the body and maintains the proper balance of acids and electrolytes, such as salts, and is a necessary function for human survival.

The flow chart illustrates this fundamental process.

The physician who specializes in the diagnosis and treatment of urinary disorders is called a urologist (ur/o is the combining form meaning “urine”; -logist means “one who studies”), and the specialty practice is urology (ur/o means “urine”; -logy means “study of”). The physician who treats the kidney and kidney disorders is called a nephrologist (nephr/o means “kidney”; -logist means “one who studies”). The area of specialty is named nephrology (nephr/o means “kidney”; -logy means “study of”) .

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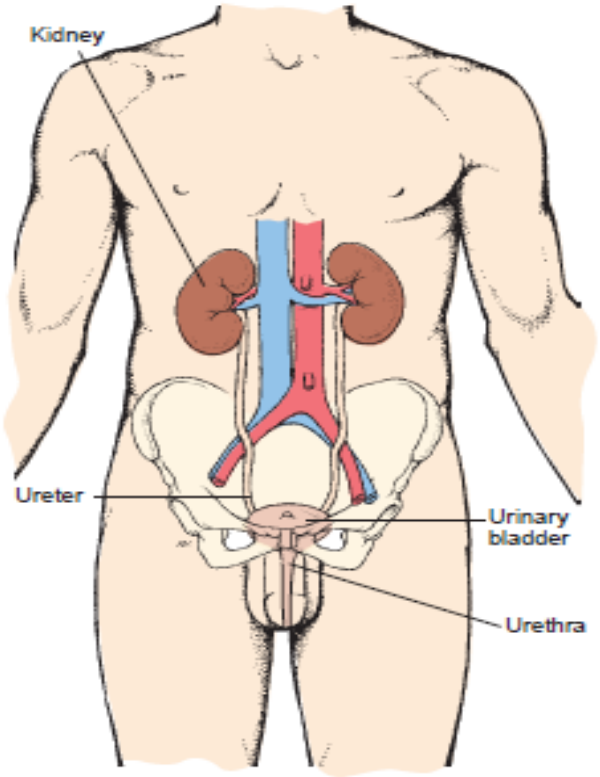
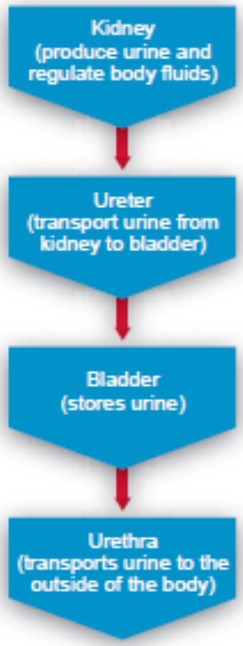


FIGURE 13-1 Primary structures of the urinary system. Anterior view of the kidneys, ureters, bladder, and urethra (male). From Stedman's Medical Dictionary, 27th Ed. Baltimore: Lippincott Williams & Wilkins, 2000.



Flow chart illustrating the process of urine formation and excretion. The process of urine formation begins in the kidneys. The kidneys filter waste products from the blood and convert them to urine. The urine is transported from the kidneys by the ureters to the bladder, where it is stored until it is expelled through the urethra via the process of urination.

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Structure and Function

The kidneys are bean-shaped organs (hence the name, kidney bean) and are about the size of a fist; they lie at the back of the abdominopelvic cavity, along each side of the spinal column. Each kidney is covered by a thin membrane called the renal capsule. A thicker layer of fatty tissue, called the perirenal (peri- means "around"; ren/o means "kidney"; -al creates the adjective form) fat , provides protection to this vital organ and surrounds the renal capsule. Finally, a thin layer of connective tissue, called the renal fascia , forms each kidney's outer covering. The hilum is the indented, or narrowest, part of the kidney, where blood vessels and nerves enter. Figure 13-2 shows the structure of the kidneys.

The kidneys remove two natural products of metabolism while producing urine: urea and uric acid , along with other waste products from the blood. The kidneys also filter, reabsorb, and secrete nonwaste products back into the system.

Filtration and the urine production process begin in the nephron , the functional unit of the kidney. Each kidney has approximately 1 million nephrons. Each nephron contains a tiny filtration unit called the glomerulus , which consists of a cluster of capillaries. As blood travels through the capillaries, a continuous exchange of substances occurs between the glomerulus and the nephron. The walls of the capillaries permit waste products, water, and electrolytes to pass through and collect in the kidney tubules. The end product, urine , is transported out of the nephron into the renal pelvis and enters the ureter , where it is carried to and stored in the urinary bladder.

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The bladder collects the urine until the volume reaches a certain level, which triggers the urge to urinate or void (expel the urine) called the micturition refl ex (comes from Latin word *micturio* , which means "to urinate"). Urine is expelled through the urethra , a tube that measures approximately 1.5 inches long in the female and 8 inches long in the male. The female urethra carries only urine, whereas the male urethra conveys both urine and semen.
Urination or voiding is regulated by two sphincters , which are circular muscles that surround the urethra. They are the internal urethral sphincter, which is located at the entrance to the urethra and is involuntarily controlled, and the external urethral sphincter, which is located at the distal end of the urethra and is under conscious control.

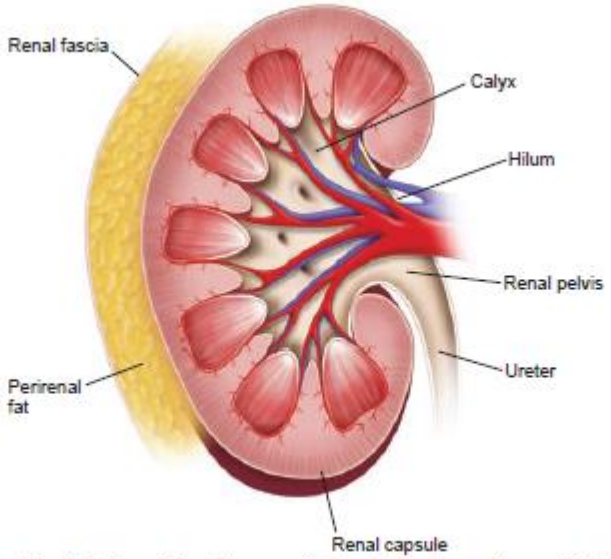

FIGURE 13-2 **Kidney.** Sagittal view of the kidney and internal structures. (From *A Short Course in Medical Terminology, First Edition*, C. Edward Collins: p. 210, Figure 14-2.)

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Disorders and Treatment

Disorders of the urinary system can encompass any or all of the urinary structures. These conditions
can range from an irritating leakage of urine when you sneeze to chronic renal failure.
Some of the more common disorders are discussed in the following sections.

INCONTINENCE AND RETENTION

Incontinence , the loss of urinary control, has many causes, some of which are listed below:

- Spinal cord damage
- Brain damage
- Prostate surgery
- Pregnancy
- Aging

Retention is the inability to empty the bladder. This may occur for a variety of reasons, such as the result of anesthesia or prostate enlargement. Sometimes with a spinal cord injury, retention occurs when the micturition reflex is blocked.

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Urinary Tract Infections

Urinary tract infections (UTIs) are extremely common. Bacteria that infect the urinary tract can ascend the urethra into the bladder. Left untreated, organisms can travel further into the urinary system. Cystitis (cyst/o means “bladder”; -itis means “inflammation”) and urethritis (urethr/o means “urethra”; -it is means “inflammation”) are infections of the lower urinary tract, generally referred to as bladder infections, whereas pyelonephritis (pyel/o means “pelvis”; nephr/o means “kidney”; -it is means “inflammation”) and nephritis (nephr/o means “kidney”; -itis means “inflammation”) are infections of the upper urinary tract, generally referred to as kidney infections. Women are more prone to bladder infections due to the shortness of the urethra, the proximity of the urethra to the anus, susceptibility to poor toilet habits, and frequent irritation through the use of tampons, bubble baths, and so on. Older males with prostate hypertrophy (enlargement) can retain urine. This may encourage bacterial growth and infection. Obstructions of the urinary tract can also promote retention of urine, leading to an infection.

Glomerulonephritis (glomerul/o means “glomerulus”; nephr/o means “kidney”; -it is means “inflammation”) can involve one or both kidneys. This infection extends from the ureter into the renal pelvis of the kidney. It can result from infections from other body systems or can be a response from the body’s immune system. Left untreated, it can cause renal failure in which the kidneys fail to produce urine.

Pain in the lower abdomen is a frequent symptom of a UTI , along with dysuria (dysmeans “painful” or “difficult”; ur/o means “urine”; -ia creates the adjective form), frequency, and urgency. Systemic signs include fever, general malaise, and leukocytosis (abnormal white blood cell counts).

Treatment of UTIs includes taking a prescribed antibiotic along with increasing fluid intake.

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Renal Failure

The kidneys can suddenly fail for many different reasons. Exposure to toxins, shock, infections such as glomerulonephritis, and other renal disorders can damage the nephrons. Symptoms include oliguria (olig/o means "scanty" or "few"; ur/o means "urine"; -ia creates the adjective form) progressing to anuria (an- means "none" or "without"; ur/o means "urine"; -ia creates the adjective form), with an increase in the patient's blood urea nitrogen (BUN) or a decrease in the glomerular filtration rate (GFR).

BUN is a blood test that detects waste products in the blood, and GFR refers to the volume of water that is filtered through the glomerulus.

The failure may be reversible if the primary problem is treated. In acute renal failure, dialysis (a method of artificial kidney function) and drug therapy with the use of diuretics (diameans "through"; ur/o means "urine"; from the Greek *dia* meaning "through" and *ourein* meaning "urine") can help a patient through the acute stages while the nephrons recover. In chronic renal failure (CRF), there is permanent damage to the kidneys. Some symptoms of CRF include anuria, azotemia or uremia (ur/o means "urine"; -emia means "blood"; presence of urea or nitrogenous wastes in the blood), and electrolyte imbalances. CRF affects all body symptoms. Hemodialysis (hemo- means "blood"; *dialyo* comes from the Greek word meaning "to separate"), peritoneal (comes from the Greek word *peritonaion* meaning "to stretch over") dialysis , or a kidney transplant is necessary to sustain life in patients with CRF.

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Urinary Tract Obstructions

Kidney stones, or renal calculi, are a common problem and can develop anywhere along the urinary tract.

They can cause an obstruction in urinary flow, which can further lead to urinary stasis and infection. With renal calculi, the patient frequently experiences intense pain in the flank region or renal colic. Treatment consists of removing the stone(s) or obstruction. This can be done using less noninvasive techniques such as through a cystoscope (cyst/o means“bladder”; -scope means “instrument used to view”), a ureteroscope (ureter/o means “ureter”;-scope means “instrument used to view”), extracorporeal shock wave lithotripsy (ESWL), or percutaneous nephrolithotomy.

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Pharmacology

Drugs used in treating diseases of the urinary system include diuretics, antibiotics, antibacterials,

and other drugs that influence the strength of contraction of the urinary bladder. Diuretics

promote urine excretion and can be divided into categories according to their action.

Other thing should be encouraged to increase their fluid intake when they have a urinary tract infection.

Some examples of urinary antibiotics include Septra, Bactrim, Macrodantin, and Furadantin.

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Abbreviation Table • The Urinary System

ABBREVIATION	MEANING
BPH	benign prostatic hypertrophy; enlarged prostate
BUN	blood urea nitrogen; a blood test to measure kidney function by the level of nitrogenous waste and urea that is in the blood
CAPD	continuous ambulatory peritoneal dialysis
ESRD	end-stage renal disease
GFR	glomerular filtration rate
IVP	intravenous pyelogram; contrast is injected into a vein and is excreted by the kidney to show the urinary system
KUB	kidneys, ureter, and bladder; also a reference to an X-ray of the kidneys, ureters, and bladder taken as a flat plate of the abdomen
PSA	prostate-specific antigen
UA	urinalysis
UTI	urinary tract infection