

Secondary Conditions  
Prevention & Treatment:  
A Series—No. 2

# Urinary Tract Infections

The Research  
and Training  
Center on  
Independent  
Living



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*Abstract:* Before World War II, nearly all persons with spinal cord injury died of urinary tract infections (UTI) and their complications. Now antibiotics and medical advances have minimized infections.

After spinal cord injury and the loss of voluntary bladder control, the brain can no longer order the bladder to empty. Therefore, a person needs to use an artificial method, some of which are:

- **Intermittent catheterization.** The insertion of a small plastic or rubber tube into the bladder so urine can drain. "Intermittent" means that a catheter is inserted and removed several times a day so urine can not build up.
- **Indwelling catheter or Foley catheter.** An inserted tube drains into a balloon device that holds the catheter in place. Urine drains to a collection device outside the body, such as a bag on a leg.
- **External catheter.** The catheter is placed on a male's penis to allow urine to drain to a leg bag.
- **Suprapubic.** The catheter is placed directly through the abdomen above the pubic area into the bladder. A hole is surgically made to create openings for the catheter.
- **Surgical opening.** Surgery is used to form a new urine pathway from the ureters. A collection bag must be worn for drainage.

Personal assistants should follow the practices recommended for hospital nurses: Wash hands before and after catheterization and when emptying drainage bag. Washing before and after prevents contamination. Ideally, the assistant should wear latex gloves throughout the process.

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# **Coping With Urinary Tract Infection**

## **Magnitude of the Problem**

The National Institute on Disability and Rehabilitation Research estimates that around 200,000 people in the U.S. live with spinal cord injuries, and 8,000 more are injured each year.

Not long ago — before World War II — nearly all spinal cord injured persons died of urinary tract infections (UTI) and their complications.

Today, thanks to antibiotics and advances in medical treatments, that's no longer true. But urinary tract infections — if not treated properly or taken seriously—still are one of the biggest threats to the health and survival of persons with paralyzing disabilities.

A national study of infections in British hospitals found that urinary tract infections were the most common hospital-acquired infection. In one study of a group of 64 spinal cord injured patients at the Spain Rehabilitation Center at the University of Alabama at Birmingham, nearly six of 10 developed urinary tract infections during the year-long surveillance. The finding suggests that persons with disabilities who have lost control of their bladder function will very likely experience UTI.

However, another interesting finding came out of the Spain Rehabilitation study. One 69-year-old complete paraplegic man never suffered any infections during the 47 weeks of observation. What did he do differently?

The only difference found by researchers was that this paraplegic was extremely meticulous in cleaning his catheters. He disinfected them with household bleach, and then boiled and wrapped the catheters in a clean diaper after each use. This suggests that urinary tract infections and complications are avoidable with the proper knowledge and self-care skills. Giving you those tools is the aim of this booklet.

## **What Is UTI?**

The normal urinary system is sterile, with no bacteria present. The kidneys filter waste and extra water out of the blood and convert them to urine. Then the urine flows down through the small tube-like ureters to the bladder. The bladder acts as a holding tank, stretching until the system is ready to empty or void.

When the bladder sends a message through the nerve pathways to the brain saying, "I'm full," the person can decide to empty. The brain sends a message back to the bladder telling it to tighten the muscles and squeeze while the bladder opening, the sphincter muscle, contracts and opens.

But, following a spinal cord injury or other damage to the spinal cord, this system malfunctions. Nerve signals letting you voluntarily urinate no longer get through between the brain and bladder. The bladder may spontaneously overflow when full, or the bladder may not be able to hold as much urine as it once did — resulting in frequent, small urinations. Some people with SCI cannot void unless they perform intermittent catheterizations. In order to know how to treat your particular bladder problem, doctors have developed many urodynamics tests.

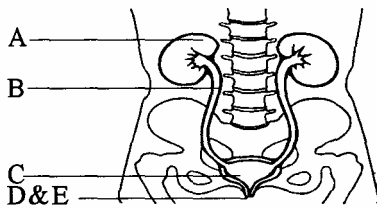
Another important test used is a urine culture which determines whether or not you have excess bacteria or an infection. It's critical that you prevent or control bacteria growth because a bad infection could possibly lead to kidney failure or death.

## **Lab Tests Pinpoint Problems**

Here are some of the primary tests your doctor may order:

**Cystourethrogram** (sys-toe-yur-eeth' -row -gram): This X-ray (also called a cystogram) reveals the size and shape of your bladder. The test involves injection of dye via catheter into your bladder so the organ will show up on the X-ray. One of the key things this test shows is whether or not excess pressure backs up urine into the kidneys (reflux). Reflux can cause kidney damage or, in serious cases, kidney failure and death.

**Cystoscopy** (sys-toss'-kaw-pee): In this test, your urologist uses a special catheter that has a light to look inside your urethra and bladder.



**A-Kidney. B-Ureter.  
C-Bladder. D-Urethra.  
E-Sphincter.**

**Figure 1**

**Cystometrogram** (sys-toe-met' - row-gram): A CMG test involves filling bladder with carbon dioxide or water to simulate the way it functions when full of urine. This test can measure the amount of pressure present, and can tell the urologist whether your bladder is spastic (upper motor neuron—holds smaller amounts) or limp (lower motor neuron—holds large amounts and spills).

**Renal Scan** (ree'-nall skan): Also called a short renal clearance, this scan measures the way the kidneys function and their blood supply. It is done using a small amount of radioactive material injected into your bloodstream so that the amount of radioactivity can be counted in various areas.

**Ultrasound:** Sound waves bounce off the urinary organs in this test and create a picture on a screen, with different colors showing the way it looks. An ultrasound can detect tumors,

cysts, and stones.

**Urodynamics** (yur-o-dye-nam'-iks): This evaluation consists of a series of observations to analyze your entire urinary system and how it empties. Knowing this allows you and your urologist to choose the bladder management program that will work best for you.

**Urine culture:** A sample of your urine is tested to search for bacteria. A further test called sensitivity testing can find which antibiotics work best to kill the bacteria.

**Urinalysis** (yur-in-al'-ihsus): This test checks the chemical and cell makeup of your urine. After you lose voluntary bladder control, you can no longer “order” your bladder to empty and you may need to use an artificial method—unless your bladder involuntarily voids on its own.

### Artificial Emptying

The primary artificial methods are:

1. One method widely used is catheterization — inserting a small plastic or rubber tube into the bladder so that urine will drain out. If the catheter is inserted and removed several times a day, it's called intermittent catheterization. Your doctor may recommend that you never let more than 400 to 500cc (about 13 to 16 ounces) of urine build up in your bladder before catheterizing. He also may tell you to drink no more than 4 ounces an hour. Those using **intermittent catheterization** often are told to “cath” every 3 to 6 hours, unless they drink more than the recommended 4-oz. level (then “cath” more often).
2. Another type of catheter is left in the bladder and is called an “**indwelling**” catheter or **Foley catheter**. The indwelling catheter is a plastic or rubber tube inserted into the bladder and left in place for drainage of urine. A “balloon” at the end is inflated inside the bladder to hold the catheter in place. The balloon must be deflated for weekly or monthly

catheter removal. Since urine drains constantly, the Foley requires a collection device such as a legbag which is strapped to the leg to store the urine until you find a bathroom.

3. An alternative to the indwelling catheter is the **condom or external catheter** (also called a Texas catheter) for males whose bladders are able to empty on their own (Reflex Voiding). The catheter is placed on the penis and allows urine to drain into the legbag. The external condom catheter can be used by men whose bladders void spontaneously without their control.
4. A fourth catheter type is the **suprapubic**, which is placed directly through the abdomen above the pubic area into the bladder. A hole or ostomy is surgically made in the abdomen and bladder to create openings for the catheter.
5. Surgery to aid in emptying includes the urinary ileostomy (ill-eos'-to-me) or ileal (ill'-e-ull) conduit, sphincterectomy, and sphincterotomy. The surgeon creates a urinary ileostomy or ileal conduit by using a section of the small intestine to form a new urinary pathway from the ureters to the abdomen where an opening is fashioned. A urinary collection bag must be worn to collect the constant drainage. In sphincterectomy, the sphincter is removed so that urine will flow more readily—but without control. In sphincterotomy, the sphincter is cut or “relaxed” so that the outlet from the bladder is not squeezed shut.

### Signs & Symptoms of Infection

<p><i>(You may not have all of them.)</i></p> <ul style="list-style-type: none"> <li>•Excruciating pain in lower back or lower abdomen, which may radiate to groin (for those who have sensation).</li> <li>•Nausea</li> <li>•Vomiting</li> <li>•Anxiety because you may not know why you are uncomfortable</li> <li>•Frequent infections</li> <li>•Fever and chills</li> <li>•Bloody urine</li> </ul>	<ul style="list-style-type: none"> <li>•Blood specimen</li> <li>•Urinalysis</li> <li>•IVP</li> <li>•Cystoscopy</li> </ul>	<p>Care is individualized depending on stone, but will include: increased fluids, straining urine, and, if you need it, taking medication or having surgery</p>	<ul style="list-style-type: none"> <li>•Re-evaluation of bladder management</li> </ul>
<p><b>IMPORTANT:</b> If at any time you see blood in your urine, call your doctor or the SCI Clinic.</p>			

### Causes of UTI

In the hospital, sterile catheterizations often are used because urinary infections are easily transmitted from one patient to another. Outside the hospital, clean catheterizations—not sterile—usually are enough. This means that the catheters must be kept clean by regular washings or frequently replaced with new ones. For indwelling catheters, the site around the catheter must be kept clean as well. Your doctor may advise you to keep the ostomy area shaved if you use a suprapubic catheter to further prevent contamination.

Doctors also advise changing the external or condom catheter daily, and air drying the skin to prevent skin breakdown which could lead to infection. Studies indicate that users of condom catheters are at increased risk of UTI, especially if they have bowel incontinence, if the

external catheter is worn for long periods, if tubing becomes kinked or clogged, or if a continuous downward flow of urine into the drainage bag isn't ensured.

Remember the story of the 69-year-old paraplegic who completely avoided infections by keeping his catheters almost hospital clean. He used household bleach (such as Clorox). But other effective disinfectants are .25% acetic acid, or hydrogen peroxide.

### **Personal Assistant Precautions**

If you use a personal assistant, he or she would be wise to follow the practices recommended for hospital nurses: Wash hands before and after catheterization and emptying of drainage bag. Washing before prevents contamination of the individual being catheterized. Washing after prevents contamination of the assistant. Ideally, the assistant should wear latex gloves when catheterizing.

In fact, if you observe nurses or other medical personnel disconnecting your indwelling catheter tubing in order to obtain a urine culture, they may be placing you at greater risk of infection.

Other studies have found that bladder irrigations (washouts) performed routinely for preventive purposes—even when there is no evidence of blockage or infection—can lead to bacteria developing a resistance to the antiseptic being used. Doctors may advise you to irrigate your bladder if you experience a lot of sediment, mucus or blood in the urine, or if your system develops bladder stones.

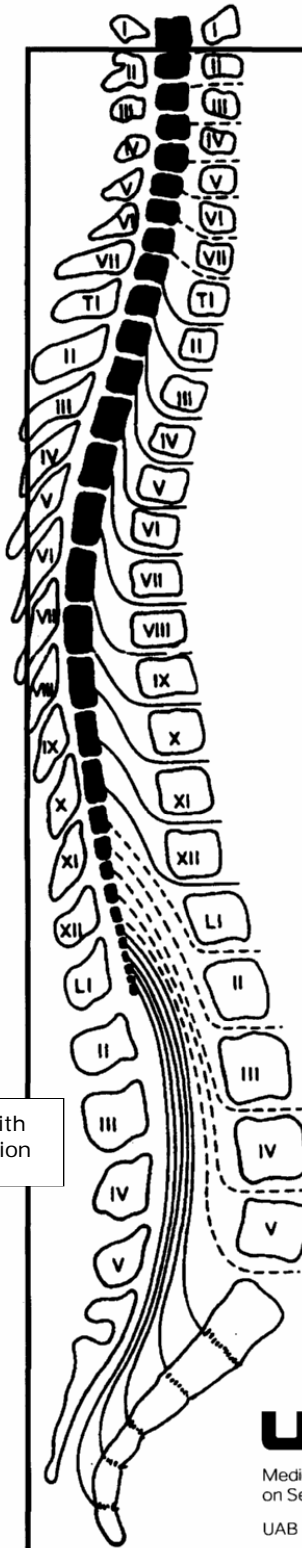
### **Preventing Odor**

You can prevent urine odor with good hygiene. In the event of urine spills, wash the clothing or wheelchair cushion right away. Use protective waterproof pads whenever possible. Remember that plastic pads may promote the development of pressure sores by allowing moisture to buildup and preventing air from circulating next to the skin. Foam cushions will soak up urine and create odor problems unless you use a waterproof cover.

If you use an indwelling catheter or external condom catheter with legbag, it's important to use cold water for rinsing and disinfecting. Those products usually are made of rubber rather than plastic, and using hot water drives the odor of urine into the catheter or drainage bag.

Fresh urine should not have a strong odor because it is somewhat acidic (a pH of 6-7). But if it becomes alkaline (pH of 8- 9), urine can have a strong, unpleasant odor. Also, alkaline urine is a better breeding ground for bacteria. Drinking carbonated beverages such as soda pop can cause alkaline urine. Water, Kool-Aid, tea, fresh cranberry or apple juice are good alternatives.

It's a good idea occasionally to roll the indwelling catheter between your fingers to check for grit. Grit can plug up the catheter and prevent drainage. If you find grit, either thoroughly clean the catheter or get a new one.



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# AUTONOMIC DYSREFLEXIA is a life threatening emergency

Autonomic dysreflexia (AD) is a potentially life-threatening condition that occurs in individuals with a spinal cord injury at level T6 or above. Patients usually present with elevated blood pressure and bradycardia. Noxious stimuli to intact sensory nerves below the injury lead to relatively unopposed sympathetic outflow and dangerous blood pressure elevations. Parasympathetic outflow through cranial nerve X (vagus) can cause reflexive bradycardia but can't compensate for severe vasoconstriction.

## COMMON SIGNS AND SYMPTOMS MAY INCLUDE:

- HYPERTENSION
- BRADYCARDIA
- POUNDING HEADACHE
- NASAL CONGESTION
- BRONCHOSPASM
- BLURRED VISION
- SEIZURES
- CHILLS WITHOUT FEVER
- SWEATING ABOVE LEVEL OF INJURY
- SKIN FLUSHING ABOVE LEVEL OF INJURY
- GOOSE BUMPS ABOVE LEVEL OF INJURY
- APPREHENSION OR ANXIETY

Follow the examination tree below to eliminate any noxious stimuli below level of injury. A drop in blood pressure will occur with the removal of the stimuli. Seizures, stroke, or death may occur if stimuli are not immediately removed.

## EXAMINATION TREE:

Sit up and take blood pressure in both arms (repeat blood pressure every 3 minutes and between steps.) **Important note** - Normal systolic BP for an individual with an SCI above T6 can be in the 90-110mm Hg range. If blood pressure elevated, give medications as indicated. Use an antihypertensive with rapid onset and short duration while the causes of AD are being investigated.

Look for Noxious Stimuli below level of injury

Check Bladder for Distention ⇨ Catheterize bladder using 2% lidocaine jelly. If indwelling catheter already in place, inspect for kinks, folds, constrictions, or obstructions. Irrigate or replace the catheter to insure patency - RELIEF? - collect U/A and C/S (Irritation may be due to infection). Assess for any urologic obstruction such as kidney or bladder stones.

Check Bowel ⇨ Anesthetize using Lidocaine jelly 2% (wait 5 minutes) prior to checking for impaction. Remove impaction and recheck blood pressure - RELIEF? - Evaluate for high impaction.

Check Skin ⇨ Remove constricting clothing - RELIEF? - Examine for pressure ulcers - Does repositioning lower blood pressure? - Examine for insect bites - Treat - RELIEF? - Examine seat cushion and wheelchair for sharp or hard objects - Evaluate environmental temperature - Do symptoms change as environmental and patient's temperature change? - Evaluate recent surgical sites - Treat symptoms - RELIEF? - Observe for ingrown toenails - Anesthetize, debride, treat for infection - RELIEF?

Evaluate for Gastrocolic Irritation ⇨ Tube feeding given recently? - Too rapid? - Treat - RELIEF? - Too cold? - Treat - RELIEF? - Too large a volume? - Treat - RELIEF?

Gender specific ⇨ **Males:** Genitalia pinched? - Correct - RELIEF? - Condom catheter too tight? - Remove catheter - RELIEF? - Reflexogenic erection? - Remove condom catheter and clothing - RELIEF?

**Females:** Menstrual cramping? - Treat - RELIEF? - Uterine contractions? - Treat - Evaluate follow-up - Vaginitis? - Treat symptoms and infection

## TREATMENT REMINDERS

1. Sit patient up.
2. Check BP often and treat elevated systolic blood pressure (>150) until cause is found and eliminated.
3. Medications commonly used for elevated BP are:
  - Nitroglycerine Paste. Apply 1-2 inches to skin q2hrs above the level of injury. May wipe off if BP stable and reapply if needed.
  - Nifedipine 10 mg capsule (immediate release form). May repeat in 20-30 minutes if needed. Avoid sublingual which can cause abrupt hypotension.
  - IV Antihypertensives. These are secondary agents to be utilized in a monitored setting.
4. Treat symptomatic hypotension by laying down the individual and elevating the legs.
5. Anesthetize noxious stimuli prior to removal to prevent exacerbation of AD.
6. Monitor symptoms and BP for at least 2 hrs after the resolution of an AD episode.
7. Admit the patient if response to treatment is poor or cause has not been identified. AD can lead to seizures, stroke, or death.

**UAB** SPAIN REHABILITATION CENTER

Medical Rehabilitation Research & Training Center  
on Secondary Conditions of Spinal Cord Injury

UAB Model Spinal Cord Injury Care System

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## Other Voiding Methods

Another set of voiding methods uses artificial stimulation to cause the bladder to empty. One method that some people can use is called "tapping." You tap the abdomen over the bladder and this triggers the bladder muscle to tighten and empty. This method often works best with spastic bladders (upper motor neuron) that hold small amounts of urine, a condition found frequently in injuries above the sacral level

**Types of Urinary Tract Infections**

Location	Signs and Symptoms	Diagnosis	Treatment	Management
Kidney (pyelonephritis)	<i>(You may not have all of the signs and symptoms)</i> <ul style="list-style-type: none"> <li>• Chills</li> <li>• Fever</li> <li>• Flank pain</li> <li>• Hematuria (bloody urine)</li> <li>• Urinary frequency</li> <li>• Cloudy, thick urine</li> <li>• Foul smelling urine</li> <li>• Sediment</li> <li>• Burning upon urination</li> <li>• Increased spasticity</li> <li>• Autonomic dysreflexia</li> </ul>	<ul style="list-style-type: none"> <li>• Urinalysis</li> <li>• Culture + sensitivity (C+S)</li> </ul>	<ul style="list-style-type: none"> <li>• Increased fluid intake</li> <li>• Antibiotics</li> <li>• Foley catheter possible</li> </ul>	<ul style="list-style-type: none"> <li>• Re-evaluate bladder management</li> </ul>
Bladder (cystitis)	Same, although you may not have a fever & chills	<ul style="list-style-type: none"> <li>• Urinalysis</li> <li>• Culture + sensitivity (C+S)</li> </ul>	<ul style="list-style-type: none"> <li>• Increased fluid intake</li> <li>• Antibiotics</li> <li>• Usually not necessary to insert foley</li> </ul>	<ul style="list-style-type: none"> <li>• Chronic attacks require re-evaluation of bladder management</li> </ul>
Testicles (epididymitis)	<ul style="list-style-type: none"> <li>• Any of the above, plus: Hot, red swollen scrotum; testicular pain in incomplete lesions</li> </ul>	<ul style="list-style-type: none"> <li>• Urinalysis</li> <li>• Culture + sensitivity (C+S)</li> </ul> Plus: <ul style="list-style-type: none"> <li>• Scrotal ultrasound</li> </ul>	<ul style="list-style-type: none"> <li>• Increased fluid intake</li> <li>• Antibiotics</li> <li>• Foley possible</li> <li>• Bed rest</li> <li>• Scrotal support to elevate scrotum</li> <li>• Hot &amp; cold compresses to scrotum</li> </ul>	<ul style="list-style-type: none"> <li>• Re-evaluation of bladder management</li> </ul>

(tailbone and lower spine).

A similar technique called crede (cruh-day) empties the bladder when you push down on the abdomen over the bladder to mechanically squeeze out the urine. Straining or bending may also perform crede. This technique may work with the limp (lower motor neuron) bladder often occurs when injury is at the sacral level of the spine. Some experts consider it unsafe for those with higher injury levels.

## Selecting a Management Program

A primary goal of a bladder management program is achieving low pressure filling and emptying. Low pressure filling happens when the bladder is relaxed and allows urine to flow in from the kidneys with no force required. If your bladder is prone to spasms, your doctor may prescribe a medication such as Ditropan to stop or reduce spasms.

Similarly, low pressure emptying means no force is required for the urine to flow from the bladder and out through the urethra.

Common causes of pressure to build up, which can lead to acute infection:

**Indwelling catheter** — Letting the catheter become blocked or kinked that causes the bladder to overfill (sometimes to over one quart of urine!).

**Intermittent catheterization** — Waiting too long before inserting the catheter that allows the bladder to overfill. Doctors advise emptying the bladder before it collects 500cc (16 ounces).

**External catheter** — If the sphincter (muscle valve) doesn't relax, the bladder must use high pressure to push urine out. If you have a history of autonomic dysreflexia, you should be particularly on guard for buildup of pressure. Also be on guard if your catheter tube gets kinked



or your legbag remains full and isn't emptied or if there is no urine in your legbag after a long time.

### **Autonomic Dysreflexia**

Autonomic dysreflexia is a serious complication sometimes related to urinary system problems —and a potentially life-threatening one. You are most at risk if your spinal cord injury is at your upper back or neck —T6 level or higher. Also called autonomic hyperreflexia, this condition can be triggered by anything that causes pain to your body. A full or spastic bladder, or bowel over-stretching (often from stool in rectum) are common emergency causes. If not treated, autonomic dysreflexia can lead to a stroke. Some warning symptoms of autonomic dysreflexia:

- Sweating on face, arms, or chest above injury.
- Bad headache.
- Red, blotchy skin on face, arms, or chest.
- Sudden high blood pressure.
- Blurry vision or spots.
- Goosebumps on arms or chest
- Slow pulse
- A feeling of doom.

If you experience any of these symptoms and suspect autonomic dysreflexia, take the following actions:

1. Remove tight clothes.
2. Sit up in bed.
3. Empty your bladder. Check your catheter or legbag for blockage or kinks. If you still don't feel better, empty your bowel.
4. Go to the hospital emergency room to see a doctor and get medication.

### **When to Change Program or See a Doctor**

When should you consider a change in bladder management program? Shirley McCluer, medical director of the Arkansas State Spinal Cord Commission, says the most frequent warning sign is acute urinary infection.

“This does not mean just a positive urine culture, but acute illness with a fever, usually over 102 degrees,” she says. McCluer recommends that anyone experiencing two episodes of acute urinary infection in six months should have a complete diagnostic workup to learn why the infections occurred. This is especially important since “each episode of acute infection does permanent damage to the kidneys.”

It may be that you don't need to change your bladder management program — but simply do a better job of following it and practicing what your doctors recommend.

Doctors often advise patients with UTI to drink more fluids, the logic being that more liquids and frequent voiding should flush the system of bacteria.

However, doctors from The Johns Hopkins School of Medicine writing in the *Journal of the American Medical Association* in April 1992 cautioned that the flushing approach shouldn't be routinely recommended for the elderly or chronically ill because of possible salt depletion, difficulty with water retention among some elderly, and possible over-dilution of antibiotics in the body. Instead, they recommend treatment of UTI with antibiotics among these groups.

UTI still is a major problem for those with spinal-cord injuries or other paralyzing conditions, but with the proper knowledge and prevention techniques, you should be able to avoid serious complications.

### **Terms You May Hear**

**Autonomic dysreflexia** (auto-nahm'-ik dis-reflecks' -see-uh) — A serious condition often resulting from urinary or bowel blockage. It can lead to a stroke and can be life-threatening. (See text for more information).

**Bacteriuria** (back-turr-ur' -ee-uh) — Presence of bacteria in the urinary system.

**Bradycardia** (bray-dee-card' -i-uh) — Slow heartbeat, with a pulse rate of less than 60 beats per minute.

**Bronchospasm** (brank' -o-spahs-um) — Sudden, involuntary contractions of the muscles of the air passages of the lungs as with asthma.

**Ileostomy** (ill-e-os' -tom-me) — Creation of a new urinary tract using a portion of the small intestine. The urinary ileostomy constantly empties on the outside of the abdomen into a collection bag. Also called an ileal conduit.

**Meatus** (mee-ay' -tis) — The opening of the urethra to the outside of the body through which urine is emptied.

**Reflux** (ree' -flucks) — Backup of urine from the bladder into the ureters or kidneys.

**Sphincter** (sfink' -turr) — The circular muscle on the urethra which acts as a gate to hold or empty urine.

**Sphincterectomy** (sfink-turr-ek' -to -me) — Removal of the sphincter so that urine can continuously flow into the bladder, but without control.

**Sphincterotomy** (sfink-turr-ot' -o-me) — Surgical incision or slicing of the sphincter to prevent it from contracting tightly and preventing urine flow into the bladder.

**Ureters** (your' -it-turrs) — The tubes leading from the kidneys to the bladder through which urine flows.

**Urethra** (your-wreath' -rah) — The tube that carries urine from the bladder to the outside of the body.