

# Prostate Enlargement: Benign Prostatic Hyperplasia

*National Kidney and Urologic Diseases Information Clearinghouse*



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## The Prostate Gland

The prostate is a walnut-sized gland that forms part of the male reproductive system. The gland is made of two lobes, or regions, enclosed by an outer layer of tissue. As the diagrams show, the prostate is located in front of the rectum and just below the bladder, where urine is stored. The prostate also surrounds the urethra, the canal through which urine passes out of the body.

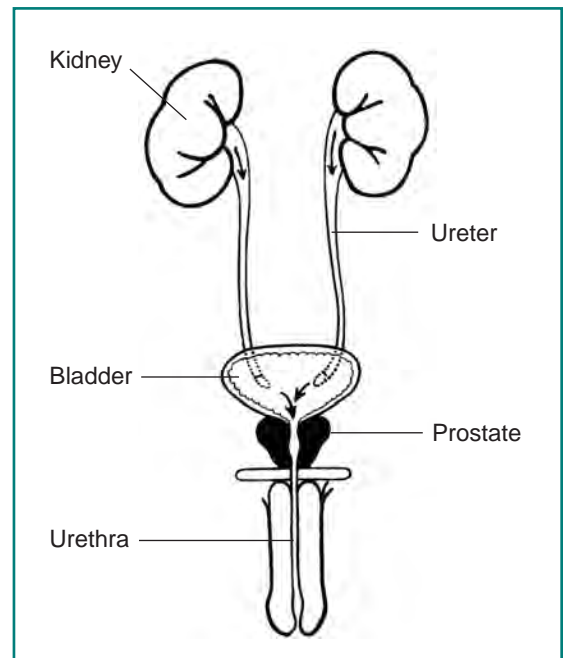
Scientists do not know all the prostate's functions. One of its main roles, though, is to squeeze fluid into the urethra as sperm move through during sexual climax. This fluid, which helps make up semen, energizes the sperm and makes the vaginal canal less acidic.

## Benign Prostatic Hyperplasia: A Common Part of Aging

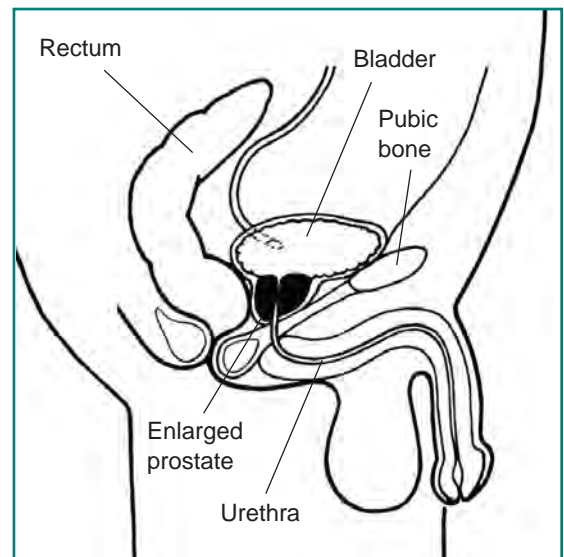
It is common for the prostate gland to become enlarged as a man ages. Doctors call this condition benign prostatic hyperplasia (BPH), or benign prostatic hypertrophy.

As a man matures, the prostate goes through two main periods of growth. The first occurs early in puberty, when the prostate doubles in size. At around age 25, the gland begins to grow again. This second growth phase often results, years later, in BPH.

Though the prostate continues to grow during most of a man's life, the enlargement



*Normal urine flow.*



*Urine flow with BPH.*



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doesn't usually cause problems until late in life. BPH rarely causes symptoms before age 40, but more than half of men in their sixties and as many as 90 percent in their seventies and eighties have some symptoms of BPH.

As the prostate enlarges, the layer of tissue surrounding it stops it from expanding, causing the gland to press against the urethra like a clamp on a garden hose. The bladder wall becomes thicker and irritable. The bladder begins to contract even when it contains small amounts of urine, causing more frequent urination. Eventually, the bladder weakens and loses the ability to empty itself, so some of the urine remains in the bladder. The narrowing of the urethra and partial emptying of the bladder cause many of the problems associated with BPH.

Many people feel uncomfortable talking about the prostate, since the gland plays a role in both sex and urination. Still, prostate enlargement is as common a part of aging as gray hair. As life expectancy rises, so does the occurrence of BPH. In the United States in 2000, there were 4.5 million visits to physicians for BPH.

## Why BPH Occurs

The cause of BPH is not well understood. No definite information on risk factors exists. For centuries, it has been known that BPH occurs mainly in older men and that it doesn't develop in men whose testes were removed before puberty. For this reason, some researchers believe that factors related to aging and the testes may spur the development of BPH.

Throughout their lives, men produce both testosterone, an important male hormone, and small amounts of estrogen, a female hormone. As men age, the amount of

active testosterone in the blood decreases, leaving a higher proportion of estrogen. Studies done on animals have suggested that BPH may occur because the higher amount of estrogen within the gland increases the activity of substances that promote cell growth.

Another theory focuses on dihydrotestosterone (DHT), a substance derived from testosterone in the prostate, which may help control its growth. Most animals lose their ability to produce DHT as they age. However, some research has indicated that even with a drop in the blood's testosterone level, older men continue to produce and accumulate high levels of DHT in the prostate. This accumulation of DHT may encourage the growth of cells. Scientists have also noted that men who do not produce DHT do not develop BPH.

Some researchers suggest that BPH may develop as a result of "instructions" given to cells early in life. According to this theory, BPH occurs because cells in one section of the gland follow these instructions and "reawaken" later in life. These "reawakened" cells then deliver signals to other cells in the gland, instructing them to grow or making them more sensitive to hormones that influence growth.

## Symptoms

Many symptoms of BPH stem from obstruction of the urethra and gradual loss of bladder function, which results in incomplete emptying of the bladder. The symptoms of BPH vary, but the most common ones involve changes or problems with urination, such as

- a hesitant, interrupted, weak stream
- urgency and leaking or dribbling
- more frequent urination, especially at night

The size of the prostate does not always determine how severe the obstruction or the symptoms will be. Some men with greatly enlarged glands have little obstruction and few symptoms while others, whose glands are less enlarged, have more blockage and greater problems.

Sometimes a man may not know he has any obstruction until he suddenly finds himself unable to urinate at all. This condition, called acute urinary retention, may be triggered by taking over-the-counter cold or allergy medicines. Such medicines contain a decongestant drug, known as a sympathomimetic. A potential side effect of this drug may prevent the bladder opening from relaxing and allowing urine to empty. When partial obstruction is present, urinary retention also can be brought on by alcohol, cold temperatures, or a long period of immobility.

It is important to tell your doctor about urinary problems such as those described above. In eight out of 10 cases, these symptoms suggest BPH, but they also can signal other, more serious conditions that require prompt treatment. These conditions, including prostate cancer, can be ruled out only by a doctor's examination.

Severe BPH can cause serious problems over time. Urine retention and strain on the bladder can lead to urinary tract infections, bladder or kidney damage, bladder stones, and incontinence—the inability to control urination. If the bladder is permanently damaged, treatment for BPH may be ineffective. When BPH is found in its earlier stages, there is a lower risk of developing such complications.

## Diagnosis

You may first notice symptoms of BPH yourself, or your doctor may find that your prostate is enlarged during a routine check-up. When BPH is suspected, you may be referred to a urologist, a doctor who specializes in problems of the urinary tract and the male reproductive system. Several tests help the doctor identify the problem and decide whether surgery is needed. The tests vary from patient to patient, but the following are the most common.

### Digital Rectal Examination (DRE)

This examination is usually the first test done. The doctor inserts a gloved finger into the rectum and feels the part of the prostate next to the rectum. This examination gives the doctor a general idea of the size and condition of the gland.

### Prostate-Specific Antigen (PSA) Blood Test

To rule out cancer as a cause of urinary symptoms, your doctor may recommend a PSA blood test. PSA, a protein produced by prostate cells, is frequently present at elevated levels in the blood of men who have prostate cancer. The U.S. Food and Drug Administration (FDA) has approved a PSA test for use in conjunction with a digital rectal examination to help detect prostate cancer in men who are age 50 or older and for monitoring men with prostate cancer after treatment. However, much remains unknown about the interpretation of PSA levels, the test's ability to discriminate cancer from benign prostate conditions, and the best course of action following a finding of elevated PSA.

A fact sheet titled “The Prostate-Specific Antigen (PSA) Test: Questions and Answers” can be found on the National Cancer Institute website at [www.cancer.gov/cancertopics/factsheet/Detection/PSA](http://www.cancer.gov/cancertopics/factsheet/Detection/PSA).

## **Rectal Ultrasound and Prostate Biopsy**

If there is a suspicion of prostate cancer, your doctor may recommend a test with rectal ultrasound. In this procedure, a probe inserted in the rectum directs sound waves at the prostate. The echo patterns of the sound waves form an image of the prostate gland on a display screen. To determine whether an abnormal-looking area is indeed a tumor, the doctor can use the probe and the ultrasound images to guide a biopsy needle to the suspected tumor. The needle collects a few pieces of prostate tissue for examination with a microscope.

## **Urine Flow Study**

Your doctor may ask you to urinate into a special device that measures how quickly the urine is flowing. A reduced flow often suggests BPH.

## **Cystoscopy**

In this examination, the doctor inserts a small tube through the opening of the urethra in the penis. This procedure is done after a solution numbs the inside of the penis so all sensation is lost. The tube, called a cystoscope, contains a lens and a light system that help the doctor see the inside of the urethra and the bladder. This test allows the doctor to determine the size of the gland and identify the location and degree of the obstruction.

## **Treatment**

Men who have BPH with symptoms usually need some kind of treatment at some time. However, a number of researchers have questioned the need for early treatment when the gland is just mildly enlarged. The results of their studies indicate that early treatment may not be needed because the symptoms of BPH clear up without treatment in as many as one-third of all mild cases. Instead of immediate treatment, they suggest regular checkups to watch for early problems. If the condition begins to pose a danger to the patient’s health or causes a major inconvenience to him, treatment is usually recommended.

Since BPH can cause urinary tract infections, a doctor will usually clear up any infection with antibiotics before treating the BPH itself. Although the need for treatment is not usually urgent, doctors generally advise going ahead with treatment once the problems become bothersome or present a health risk.

The following section describes the types of treatment that are most commonly used for BPH.

## **Drug Treatment**

Over the years, researchers have tried to find a way to shrink or at least stop the growth of the prostate without using surgery. The FDA has approved six drugs to relieve common symptoms associated with an enlarged prostate.

Finasteride (Proscar), FDA-approved in 1992, and dutasteride (Avodart), FDA-approved in 2001, inhibit production of the hormone DHT, which is involved with prostate enlargement. The use of either of these drugs can either prevent progression of growth of the prostate or actually shrink the prostate in some men.

The FDA also approved the drugs terazosin (Hytrin) in 1993, doxazosin (Cardura) in 1995, tamsulosin (Flomax) in 1997, and alfuzosin (Uroxatral) in 2003 for the treatment of BPH. All four drugs act by relaxing the smooth muscle of the prostate and bladder neck to improve urine flow and to reduce bladder outlet obstruction. The four drugs belong to the class known as alpha blockers. Terazosin and doxazosin were developed first to treat high blood pressure. Tamsulosin and alfuzosin were developed specifically to treat BPH.

The Medical Therapy of Prostatic Symptoms (MTOPS) Trial, supported by the National Institute of Diabetes and Digestive and Kidney Diseases (NIDDK), recently found that using finasteride and doxazosin together is more effective than using either drug alone to relieve symptoms and prevent BPH progression. The two-drug regimen reduced the risk of BPH progression by 67 percent, compared with 39 percent for doxazosin alone and 34 percent for finasteride alone.

### **Minimally Invasive Therapy**

Because drug treatment is not effective in all cases, researchers in recent years have developed a number of procedures that relieve BPH symptoms but are less invasive than conventional surgery.

**Transurethral microwave procedure.** In 1996, the FDA approved a device that uses microwaves to heat and destroy excess prostate tissue. In the procedure called transurethral microwave thermotherapy (TUMT), the device sends computer-regulated microwaves through a catheter to heat selected portions of the prostate to at least 111 degrees Fahrenheit. A cooling system protects the urinary tract during the procedure.

The procedure takes about 1 hour and can be performed on an outpatient basis without general anesthesia. TUMT has not been reported to lead to erectile dysfunction or incontinence.

Although microwave therapy does not cure BPH, it reduces urinary frequency, urgency, straining, and intermittent flow. It does not correct the problem of incomplete emptying of the bladder. Ongoing research will determine any long-term effects of microwave therapy and who might benefit most from this therapy.

**Transurethral needle ablation.** Also in 1996, the FDA approved the minimally invasive transurethral needle ablation (TUNA) system for the treatment of BPH.

The TUNA system delivers low-level radiofrequency energy through twin needles to burn away a well-defined region of the enlarged prostate. Shields protect the urethra from heat damage. The TUNA system improves urine flow and relieves symptoms with fewer side effects when compared with transurethral resection of the prostate (TURP). No incontinence or impotence has been observed.

**Water-induced thermotherapy.** This therapy uses heated water to destroy excess tissue in the prostate. A catheter containing multiple shafts is positioned in the urethra so that a treatment balloon rests in the middle of the prostate. A computer controls the temperature of the water, which flows into the balloon and heats the surrounding prostate tissue. The system focuses the heat in a precise region of the prostate. Surrounding tissues in the urethra and bladder are protected. Destroyed tissue either escapes with urine through the urethra or is reabsorbed by the body.

**High-intensity focused ultrasound.** The use of ultrasound waves to destroy prostate tissue is still undergoing clinical trials in the United States. The FDA has not yet approved high-intensity focused ultrasound.

## Surgical Treatment

Most doctors recommend removal of the enlarged part of the prostate as the best long-term solution for patients with BPH. With surgery for BPH, only the enlarged tissue that is pressing against the urethra is removed; the rest of the inside tissue and the outside capsule are left intact. Surgery usually relieves the obstruction and incomplete emptying caused by BPH. The following section describes the types of surgery that are used.

**Transurethral surgery.** In this type of surgery, no external incision is needed. After giving anesthesia, the surgeon reaches the prostate by inserting an instrument through the urethra.

A procedure called transurethral resection of the prostate (TURP) is used for 90 percent of all prostate surgeries done for BPH. With TURP, an instrument called a resectoscope is inserted through the penis. The resectoscope, which is about 12 inches long and 1/2 inch in diameter, contains a light, valves for controlling irrigating fluid, and an electrical loop that cuts tissue and seals blood vessels.

During the 90-minute operation, the surgeon uses the resectoscope's wire loop to remove the obstructing tissue one piece at a time. The pieces of tissue are carried by the fluid into the bladder and then flushed out at the end of the operation.

Most doctors suggest using TURP whenever possible. Transurethral procedures are

less traumatic than open forms of surgery and require a shorter recovery period. One possible side effect of TURP is retrograde, or backward, ejaculation. In this condition, semen flows backward into the bladder during climax instead of out the urethra.

Another surgical procedure is called transurethral incision of the prostate (TUIP). Instead of removing tissue, as with TURP, this procedure widens the urethra by making a few small cuts in the bladder neck, where the urethra joins the bladder, and in the prostate gland itself. Although some people believe that TUIP gives the same relief as TURP with less risk of side effects such as retrograde ejaculation, its advantages and long-term side effects have not been clearly established.

**Open surgery.** In the few cases when a transurethral procedure cannot be used, open surgery, which requires an external incision, may be used. Open surgery is often done when the gland is greatly enlarged, when there are complicating factors, or when the bladder has been damaged and needs to be repaired. The location of the enlargement within the gland and the patient's general health help the surgeon decide which of the three open procedures to use.

With all the open procedures, anesthesia is given and an incision is made. Once the surgeon reaches the prostate capsule, he or she scoops out the enlarged tissue from inside the gland.

**Laser surgery.** In March 1996, the FDA approved a surgical procedure that employs side-firing laser fibers and Nd: YAG lasers to vaporize obstructing prostate tissue. The doctor passes the laser fiber through the urethra into the prostate using a cystoscope and then delivers several bursts of energy

lasting 30 to 60 seconds. The laser energy destroys prostate tissue and causes shrinkage. As with TURP, laser surgery requires anesthesia and a hospital stay. One advantage of laser surgery over TURP is that laser surgery causes little blood loss. Laser surgery also allows for a quicker recovery time. But laser surgery may not be effective on larger prostates. The long-term effectiveness of laser surgery is not known.

Newer procedures that use laser technology can be performed on an outpatient basis.

**Photoselective vaporization of the prostate (PVP).** PVP uses a high-energy laser to destroy prostate tissue and seal the treated area.

**Interstitial laser coagulation.** Unlike other laser procedures, interstitial laser coagulation places the tip of the fiberoptic probe directly into the prostate tissue to destroy it.

## Your Recovery After Surgery in the Hospital

The amount of time you will stay in the hospital depends on the type of surgery you had and how quickly you recover.

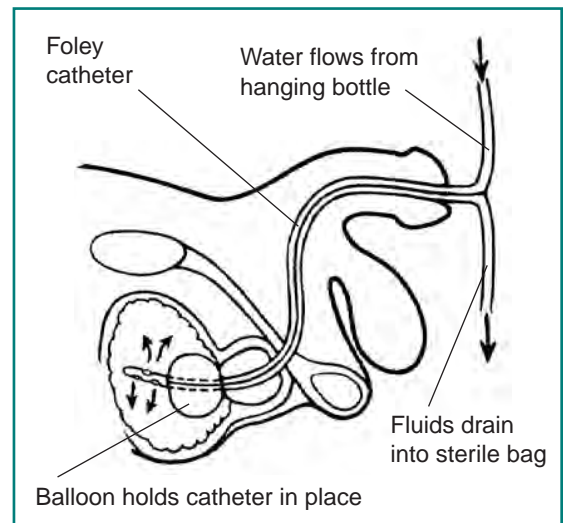
At the end of surgery, a special catheter is inserted through the opening of the penis to drain urine from the bladder into a collection bag. Called a Foley catheter, this device has a water-filled balloon on the end that is put in the bladder, which keeps it in place.

This catheter is usually left in place for several days. Sometimes, the catheter causes recurring painful bladder spasms the

day after surgery. These spasms may be difficult to control, but they will eventually disappear.

You may also be given antibiotics while you are in the hospital. Many doctors start giving this medicine before or soon after surgery to prevent infection. However, some recent studies suggest that antibiotics may not be needed in every case, and your doctor may prefer to wait until an infection is present to give them.

After surgery, you will probably notice some blood or clots in your urine as the wound starts to heal. If your bladder is being irrigated (flushed with water), you may notice that your urine becomes red once the irrigation is stopped. Some bleeding is normal, and it should clear up by the time you leave the hospital. During your recovery, it is important to drink a lot of water (up to 8 cups a day) to help flush out the bladder and speed healing.



*Foley Catheter.*

## Do's and Don'ts Following Surgery

Take it easy the first few weeks after you get home. You may not have any pain, but you still have an incision that is healing—even with transurethral surgery, where the incision can't be seen. Since many people try to do too much at the beginning and then have a setback, it is a good idea to talk with your doctor before resuming your normal routine. During this initial period of recovery at home, avoid any straining or sudden movements that could tear the incision. Here are some guidelines:

- Continue drinking a lot of water to flush the bladder.
- Avoid straining when having a bowel movement.
- Eat a balanced diet to prevent constipation. If constipation occurs, ask your doctor if you can take a laxative.
- Don't do any heavy lifting.
- Don't drive or operate machinery.

## Getting Back to Normal After Surgery

Even though you should feel much better by the time you leave the hospital, it will probably take a couple of months for you to heal completely. During the recovery period, the following are some common problems that can occur.

### Problems Urinating

You may notice that your urinary stream is stronger right after surgery, but it may take awhile before you can urinate completely normally again. After the catheter is removed, urine will pass over the surgical wound on the prostate, and you may initially have some discomfort or feel a sense of urgency when you urinate. This problem will gradually lessen, and after a couple of months you should be able to urinate less frequently and more easily.

### Incontinence

As the bladder returns to normal, you may have some temporary problems controlling urination, but long-term incontinence rarely occurs. Doctors find that the longer problems existed before surgery, the longer it takes for the bladder to regain its full function after the operation.

### Bleeding

In the first few weeks after transurethral surgery, the scab inside the bladder may loosen, and blood may suddenly appear in the urine. Although this can be alarming, the bleeding usually stops with a short period of resting in bed and drinking fluids. However, if your urine is so red that it is difficult to see through or if it contains clots or if you feel any discomfort, be sure to contact your doctor.



## Sexual Function After Surgery

Many men worry about whether surgery for BPH will affect their ability to enjoy sex. Some sources state that sexual function is rarely affected, while others claim that it can cause problems in up to 30 percent of cases. However, most doctors say that even though it takes awhile for sexual function to return fully, with time, most men are able to enjoy sex again.

Complete recovery of sexual function may take up to 1 year, lagging behind a person's general recovery. The exact length of time depends on how long after symptoms appeared that BPH surgery was done and on the type of surgery. Following is a summary of how surgery is likely to affect the following aspects of sexual function.

### Erections

Most doctors agree that if you were able to maintain an erection shortly before surgery, you will probably be able to have erections afterward. Surgery rarely causes a loss of erectile function. However, surgery cannot usually restore function that was lost before the operation.

### Ejaculation

Although most men are able to continue having erections after surgery, a prostate procedure frequently makes them sterile (unable to father children) by causing a condition called retrograde ejaculation or dry climax.

During sexual activity, sperm from the testes enters the urethra near the opening of the bladder. Normally, a muscle blocks off the entrance to the bladder, and the semen is expelled through the penis. However, the coring action of prostate surgery cuts this muscle as it widens the neck of the bladder. Following surgery, the semen takes the path of least resistance and enters the wider opening to the bladder rather than being expelled through the penis. Later it is harmlessly flushed out with urine. In some cases, this condition can be treated with a drug called pseudoephedrine, found in many cold medicines, or imipramine. These drugs improve muscle tone at the bladder neck and keep semen from entering the bladder.

### Orgasm

Most men find little or no difference in the sensation of orgasm, or sexual climax, before and after surgery. Although it may take some time to get used to retrograde ejaculation, you should eventually find sex as pleasurable after surgery as before.

Many people have found that concerns about sexual function can interfere with sex as much as the operation itself. Understanding the surgical procedure and talking over any worries with the doctor before surgery often help men regain sexual function earlier. Many men also find it helpful to talk with a counselor during the adjustment period after surgery.

## Is Further Treatment Needed?

In the years after your surgery, it is important to continue having a rectal examination once a year and to have any symptoms checked by your doctor.

Since surgery for BPH leaves behind a good part of the gland, it is still possible for prostate problems, including BPH, to develop again. However, surgery usually offers relief from BPH for at least 15 years. Only 10 percent of the men who have surgery for BPH eventually need a second operation for enlargement. Usually these are men who had the first surgery at an early age.

Sometimes, scar tissue resulting from surgery requires treatment in the year after surgery. Rarely, the opening of the bladder becomes scarred and shrinks, causing obstruction. This problem may require a surgical procedure similar to transurethral incision (see section on Surgical Treatment). More often, scar tissue may form in the urethra and cause narrowing. The doctor can solve this problem during an office visit by stretching the urethra.

## Prostatic Stents

A stent is a small device that is inserted through the urethra to the narrowed area and allowed to expand, like a spring. The stent pushes back the prostatic tissue, widening the urethra. It is designed to relieve urinary obstruction in men and improve the ability to urinate. The device is approved for use in men for whom other standard surgical procedures to correct urinary obstruction have failed.

## BPH and Prostate Cancer: No Apparent Relation

Although some of the signs of BPH and prostate cancer are the same, having BPH does not seem to increase the chances of getting prostate cancer. Nevertheless, a man who has BPH may have undetected prostate cancer at the same time or may develop prostate cancer in the future. For this reason, the National Cancer Institute and the American Cancer Society recommend that all men over 40 have a rectal examination once a year to screen for prostate cancer.

After BPH surgery, the tissue removed is routinely checked for hidden cancer cells. In about one out of 10 cases, some cancer tissue is found, but often it is limited to a few cells of a nonaggressive type of cancer, and no treatment is needed.

## Hope Through Research

The National Institute of Diabetes and Digestive and Kidney Diseases (NIDDK) was established by Congress in 1950 as one of the National Institutes of Health (NIH), whose mission is to improve human health through biomedical research. NIH is the research branch of the U.S. Department of Health and Human Services.

The NIDDK conducts and supports a variety of research in diseases of the kidney and urinary tract. Much of the research targets disorders of the lower urinary tract, including BPH, urinary tract infection, interstitial cystitis, urinary obstruction, prostatitis, and urinary stones. The knowledge gained from these studies is advancing scientific understanding of why BPH develops and may lead to improved methods of diagnosing and treating prostate enlargement.

One such study was the MTOPS Trial, which ended in 2003. The results are summarized above under the Drug Treatment section.

## Additional Reading

American Urological Association. Guideline on the management of benign prostatic hyperplasia: Chapter 1: Diagnosis and treatment recommendations. *The Journal of Urology*. 2003;170(2 Pt 1):530–537.

National Cancer Institute. The prostate-specific antigen (PSA) test: Questions and answers. [www.cancer.gov/cancertopics/factsheet/Detection/PSA](http://www.cancer.gov/cancertopics/factsheet/Detection/PSA). Reviewed August 17, 2004.

## Glossary

**Anesthesia:** A substance that prevents pain from being felt, given before an operation.

**Anus:** The opening of the rectum where solid waste leaves the body.

**Bladder:** The muscular bag in the lower abdomen where urine is stored.

**Catheter:** A tube inserted through the penis to the bladder in order to drain urine from the body.

**Cystoscope:** A tube-like instrument used to view the interior of the bladder.

**Ejaculation:** Discharging semen from the penis during sexual climax.

**Gland:** An organ that makes and releases substances to other parts of the body.

**Hormone:** A substance that stimulates the function of a gland.

**Impotent:** Unable to have an erection.

**Incontinence:** The inability to control urination.

**Obstruction:** A clog or blockage that prevents liquid from flowing easily.

**Rectum:** The last part of the large intestine (colon) ending in the anus.

**Reproductive system:** The bodily systems that allow men and women to have children.

**Scrotum:** The sac of skin that contains the testes.

**Semen:** The fluid, containing sperm, which comes out of the penis during sexual excitement.

**Sterile:** Unable to father children.

**Testes:** The male reproductive glands where sperm are produced.

**Ultrasound:** A type of test in which sound waves too high to hear are aimed at a structure to produce an image of it.

**Urinary tract:** The path that urine takes as it leaves the body. It includes the kidneys, ureters, bladder, and urethra.

**Urination:** Discharge of liquid waste from the body.

**Urethra:** The canal inside the penis that urine passes through as it leaves the body.

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U.S. DEPARTMENT OF HEALTH  
AND HUMAN SERVICES  
National Institutes of Health

NIH Publication No. 07-3012  
June 2006