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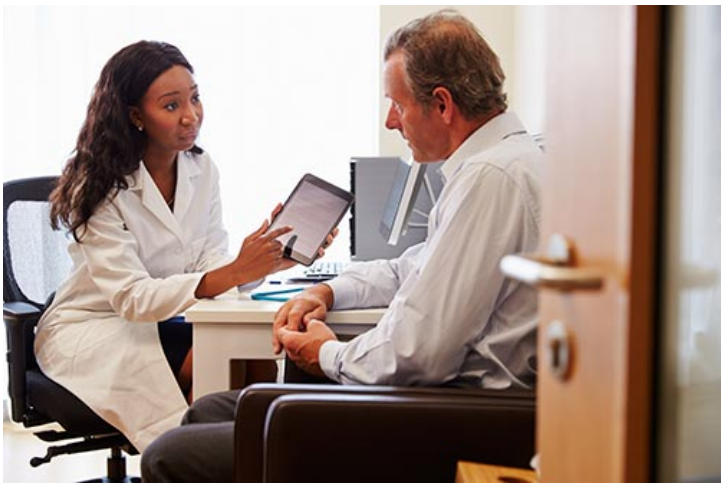
Prostate Cancer

Prostate cancer is a tumor of the prostate gland, which is located in front of the rectum, below the bladder and above the base of the penis. Your doctor may perform a physical exam, prostate-specific antigen (PSA) blood test or digital rectal exam to help diagnose your condition. If cancer is detected, your doctor may use prostate ultrasound or prostate MRI to help determine its extent and where to perform a biopsy. An ultrasound- or MRI-guided needle biopsy may be performed to confirm the diagnosis. Treatment options include surgery, radiation therapy, systemic therapy, and active surveillance.



What is prostate cancer?

Prostate cancer is a tumor of the prostate, a gland that is located in front of the rectum, above the base of the penis and below the bladder, where urine is stored. The prostate gland surrounds the first part of the urethra, the tube that connects the bladder with the tip of the penis and carries urine and other fluids out of the body. The prostate helps make the milky fluid called semen that carries sperm out of the body when a man ejaculates. Prostate cancer is typically a slow growing cancer that shows few symptoms, but some types may be aggressive and spread rapidly.

Prostate cancer is the most common form of cancer in American men. It is most prevalent in men over age 65 and fairly common in men 50-64 years old. However, prostate cancer can occur in men younger than 50. The incidence of diagnosed prostate cancer among American men has increased dramatically since 1990 because of the use of a screening blood test called prostate-specific antigen (PSA). More recently, men below the age of 65 years have shown an increased incidence of this disease.

Risk factors of prostate cancer include:

- Age
- Race, especially men of African-American descent
- Obesity

- Family history of prostate cancer
- Diet high in fats from red meat
- History of sexually transmitted disease (STD)

Prostate cancer shows few symptoms until its advanced stages. These symptoms include:

- Blood in urine or semen
- Lower back, pelvic or hip pain
- Urination issues
- Erectile dysfunction

In some cases of early prostate cancer, there are no symptoms and the cancer is often discovered through routine screening with PSA blood test and/or digital rectal examination of the prostate.

How is prostate cancer diagnosed and evaluated?

Your primary doctor will begin by asking you about your medical history, risk factors and symptoms. You will also undergo a physical exam.

Many patients undergo regular prostate cancer screening before there are even symptoms of the disease. Prostate screening includes one or more of the following tests:

- Prostate-specific antigen (PSA): This test analyzes a blood sample for higher than normal levels of prostate-specific antigen, a protein produced by the prostate glands. Higher levels of this protein could indicate the presence of cancer.
- Digital Rectal Exam (DRE): This test examines the lower rectum and the prostate gland to check for abnormalities in size, shape or texture. The term "digital" refers to the clinician's use of a gloved, lubricated finger to conduct the exam.

If a tumor is found through screening, the following imaging tests may be performed to evaluate it:

- Prostate Ultrasound: This imaging test, also called transrectal ultrasound, provides images of the prostate gland and surrounding tissue. The exam typically requires insertion of an ultrasound probe into the rectum. The probe sends and receives sound waves through the wall of the rectum into the prostate gland which is located in front of the rectum.
- Prostate MRI: MRI uses a powerful magnetic field, radio frequency pulses and a computer to produce detailed pictures of organs, soft tissues, bone and virtually all other internal body structures. The images can be examined on a computer monitor, transmitted electronically, printed or copied to a CD. MRI does not use ionizing radiation (x-rays). The test is commonly used to determine if the cancer is confined to the prostate or if it has spread to nearby lymph nodes or bone.

- Biopsy: Prostate biopsies are normally done with ultrasound guidance. These are often done in a systematic way to remove a small amount of tissue with a needle from representative areas throughout the prostate gland. If there is a suspicious nodule then special care is taken to biopsy that area.
- Bone Scan: A bone scan is typically performed to determine if cancer from another area of the body, such as the prostate, has spread to the bones. A bone scan uses small amounts of radioactive materials called radiotracers that are injected into the bloodstream. The radiotracer travels through the area being examined and gives off radiation in the form of gamma rays which are detected by a special gamma camera and a computer to create images of your bones.

How is prostate cancer treated?

There are many treatment options for prostate cancer that is confined to the prostate gland. Each option should be considered carefully, balancing the advantages against the disadvantages as they relate to the individual's age, overall health, the aggressiveness and/or stage of the cancer and the patient's personal preferences.

Historical standard options include:

- Surgery (radical prostatectomy): An incision is made in the lower abdomen or through the perineum (between the anus and the scrotum), and the prostate is removed. Incomplete surgery, in which the entire tumor cannot be removed, may need to be followed by radiation therapy. The patient is required to keep a urinary catheter in place for a number of weeks after the procedure. Possible side effects of surgery can include incontinence (inability to control urination) and impotence (inability to achieve erection). More recently, several centers are using three small incisions to do robot-assisted prostatectomy that may result in shorter hospitalization and faster recuperation. This may be preferable for selected patients, but not for all.
- External beam therapy (EBT): a method for delivering a beam of high-energy x-rays or proton beams to the location of the tumor. The radiation beam is generated outside the patient (usually by a linear accelerator for photon/x-ray and a cyclotron or synchrotron for proton beam) and is targeted at the tumor site. These radiation beams can destroy the cancer cells, and conformal treatment plans allow the surrounding normal tissues to be spared. See the External Beam Therapy pagefor more information.
- Active surveillance: No treatment, with careful observation and medical monitoring.

Newer, advanced treatment options have been developed over the past few decades. These newer options avoid or minimize some of the unpleasant side effects sometimes associated with the standard therapies. These options include:

- Nerve-sparing radical prostatectomy: Surgical procedure in which the prostate gland is removed without severing the critical nearby nerves that send signals between the brain and penis to allow normal sexual functioning. A skilled and experienced surgeon may be able to preserve sexual function for some patients by successfully using this procedure.

- Conformal or intensity modulated external beam radiation therapy: External beam radiation therapy uses high energy photons which can kill cancer cells. Conformal or intensity modulated radiation therapy techniques use advanced technology to tailor the radiation therapy to an individual's body structures. Relying on computerized three-dimensional images of the prostate, bladder and rectum, the x-ray radiation beam is shaped to conform to the prostate gland and sometimes to nearby lymph nodes. In this way, less radiation reaches the surrounding normal tissues. Today there are two levels of conformal radiation therapy: 3-D conformal radiation therapy and intensity modulated radiation therapy (IMRT). Both allow for increased doses to the tumor while protecting the normal surrounding organs. IMRT is considered the more highly focused of the two. Treatments are typically given daily (Monday through Friday) for four to nine weeks. For more detailed information see the IMRT page
- Stereotactic Body Radiation Therapy (SBRT), another form of conformal external beam radiation therapy, uses photon or x-ray therapy at a much larger dose per treatment to treat the prostate over one to two weeks with four to five treatments. SBRT requires higher precision and requires special equipment. Not all patients are candidates for SBRT.
- Proton beam therapy: a type of conformal radiation therapy that bombards the diseased tissue with proton particles instead of x-rays (photons). With a multiple beam setup, the high-dose area around the tumor is similar between protons and x-rays with IMRT. There is, however, less low- and moderate-dose radiation delivered to surrounding normal tissues (bowels, bladder, bone, soft tissues) with protons. Proton beam therapy is more costly compared to other radiation treatments, and the potential clinical benefits are currently the subject of ongoing investigation. Proton facilities are much less available in the U.S. See the Proton Therapy page for more information.
- Image-guided radiation therapy (IGRT): For 3-D conformal, IMRT, SBRT or proton therapy, daily image guidance is increasingly used to improve the setup due to organ movement. Since the prostate position varies day-to-day depending on bladder and rectal filling, the prostate position must be localized and verified prior to each treatment. In one method, several fiducial markers (tiny pieces of biologically inert material such as gold or carbon) are placed in the prostate gland before the simulation. Digital x-ray images are taken which localize the metallic markers to check the position of the prostate on a daily basis just before the treatment and make appropriate adjustments and alignment of the prostate within the planned high-dose radiation treatment field. Another method involves using ultrasound to localize the prostate before each treatment. The patient is asked to keep his bladder full as much as possible in order to produce a good ultrasound image and to displace the bladder mucosa out of the radiation treatment field. Other methods involve the use of low-dose computed tomography (CT) scanning and/or MRI scanning of the prostate in the treatment couch prior to each treatment to verify prostate position. Depending on your case and the available technology at your treatment center, your physician will inform you of which type of IGRT you will receive.
- Cryotherapy: A procedure that uses extremely low temperatures (-190°C) to freeze and destroy cancer cells. Some experienced physicians have had good results with low complication rates using cryotherapy; however, others have not. This should be considered experimental at this time as upfront treatment for prostate cancer, until there is longer follow-up for patients treated with this modality. This technique was developed as an alternative to surgery for patients who have

recurrent cancer in the prostate after radiation treatments. See Cryotherapy for additional information.

- Brachytherapy: Radiation treatment is delivered to the prostate via the placement of radioactive materials inside the prostate. There are two forms of brachytherapy, including low-dose rate (LDR) and high-dose rate (HDR):

    - Low-dose rate (LDR) brachytherapy or permanent seed implant treatment: About one hundred small radioactive seeds are inserted into the prostate gland through hollow needles under ultrasound or MRI guidance. These radioactive seeds deliver radiation continuously over a period of several weeks to months then become inactive. These metal seeds remain in the prostate forever. While the implant technique has been around for decades, recent advances in imaging technology have made it more effective. Prior to the implant, imaging such as CT, MRI or ultrasound is performed in order to plan the procedure. The implant procedure is done under conscious sedation or local/regional anesthesia. During the implant procedure, ultrasound (or sometimes MRI) is used to see the prostate gland better. Using needles, physicians can insert the seeds into the prostate more carefully transperineally (through the skin behind the testicle and in front of the anus). This is an outpatient procedure, and the patient may be required to keep a urinary catheter in place for about a week. Long-term results are available for up to 15 to 20 years at some institutions. These results show that in experienced centers, ultrasound-guided radioactive seed implantation is highly effective in controlling prostate cancer and has essentially the same result as surgery or external beam radiation for appropriately selected prostate cancer patients.

    - High Dose Rate (HDR) Brachytherapy: This technique was developed to supplement external beam therapy to treat patients with high risk prostate cancer. Patients receive about five weeks of external beam radiation therapy, followed by one to three HDR brachytherapy sessions. In this treatment, the radiation is delivered into the prostate via radioactive isotopes (often, Iridium-192) temporarily. This procedure is done as an in-patient procedure. First, about 12 to 18 hollow catheters are inserted into the prostate transperineally using ultrasound and x-ray guidance while patient is under general anesthesia. Then, a CT scan and treatment planning are done to determine location and duration of the placement of the Iridium-192 source. When the patient receives treatment, these catheters are connected to the HDR machine, which controls the delivery of the Iridium-192 radioactive source to the specific areas in each of these catheters. The treatment often lasts about 10 to 20 minutes per session, and the patient usually receives three to four sessions over a two-day period. At the end of the last session, the catheters are removed from the patient, and he is released from the hospital. While the catheters are in the prostate, the patient is required to be bed-ridden and hospitalized during that two-day period. The patient does not have permanent radioactive materials when he leaves the hospital and may be required to keep a urinary catheter in place for about a week. Use of this technique by itself (i.e., without the external beam treatments) is currently under clinical investigation. See the Brachytherapy page for more information.

- Radium 223 treatment: Radium 223, sold under the brand name Xofigo (pronounced zoh-fee-go), is an isotope of the metal radium that is used to treat prostate cancers that have spread to the bones.

Because of its chemical similarity to calcium, radium is absorbed by bone cells. Because cancer cells are more active than normal bone cells, they are more likely to absorb the radium 223. Once the radium is in the bones, it releases radiation within a very small area to kill the nearby cancer cells while sparing the healthy bone cells surrounding the cancer. Radium 223 is effective at controlling advanced prostate cancer and reducing pain in more than one area of the bone because it travels throughout the body. The injection takes up to a minute and is typically repeated every four weeks for up to six or more total treatments. Treatment is performed on an outpatient basis, so you may return home afterwards. The side effects of radium 223 include diarrhea, anemia and pain in the areas of the tumor where the radium is working. Men who receive radium treatment shouldn't father children for at least six months because radium may cause sperm damage.

For additional information see Prostate Cancer Treatment.

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