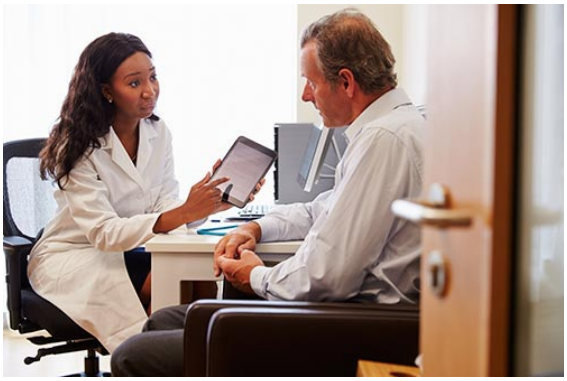
RadiologyInfo.org
For patients

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 gland. The gland sits in front of the rectum, above the base of the penis, and below the bladder (http://www.radiologyinfo.org) . The prostate surrounds the first part of the urethra (http://www.radiologyinfo.org) . The prostate helps make the milky fluid called semen. Semen carries sperm (http://www.radiologyinfo.org) out of the body when a man ejaculates. Prostate cancer is typically slow growing with few symptoms, 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 common in men 50-64 years old. However, prostate cancer can occur in men younger than 50. Prostate-specific antigen (PSA) screening has dramatically improved the diagnosis of prostate cancer. As a result, men below the age of 65 years show 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 or 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. Routine screening with PSA blood test and/or digital rectal examination often discovers prostate cancer.

How is prostate cancer diagnosed and evaluated?

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

Many patients undergo regular prostate cancer screening before symptoms appear. Screening may involve one or more of the following tests:

- **Prostate-specific antigen (PSA):** This test analyzes a blood sample for levels of PSA, a protein the prostate produces. Higher PSA levels could indicate cancer is present.
- Digital Rectal Exam (DRE): (http://www.radiologyinfo.org) This test examines the lower rectum and the prostate gland (http://www.radiologyinfo.org) to check for abnormalities in size, shape or texture. The term "digital" refers to the doctor's use of a gloved, lubricated finger to conduct the exam.

If screening test results are abnormal, your doctor may perform the following imaging tests:

- Prostate Ultrasound: (https://www.radiologyinfo.org/en/info/us-prostate) Also called transrectal ultrasound, this test provides images of the prostate and surrounding tissue. The exam typically inserts an ultrasound probe into the rectum. The probe sends and receives sound waves through the wall of the rectum into the prostate which sits in front of the rectum. Your doctor may use ultrasound to guide a needle biopsy.
- Prostate MRI: (https://www.radiologyinfo.org/en/info/mr_prostate) MRI uses a powerful magnetic field, radio frequency pulses and a computer. It produces detailed pictures of organs, soft tissues, bone and virtually all other internal body structures. The doctor can examine the images on a computer monitor, transmit them electronically, print them, or copy them to a CD. MRI does not use radiation (x-rays). Your doctor will use MRI to determine if the cancer has spread to nearby lymph nodes or bone.
    - **Prostate Mp-MRI:** Multiparametric MRI is an advanced imaging exam that is increasing in use. It combines three MRI techniques to provide information on the prostate's structure and function.
- Biopsy: (https://www.radiologyinfo.org/en/info/biopgen) This procedure removes a small amount of tissue with a needle from several areas in the prostate.
    - Real-time ultrasound, MR or Mp-MRI may guide biopsies.
    - MR and Mp-MRI images may also be fused with real-time ultrasound images to guide biopsy needles.
- Bone Scan: (https://www.radiologyinfo.org/en/info/bone-scan) Your doctor may perform a bone scan to determine if cancer has spread to your bones. A bone scan injects small amounts of radioactive material called a radiotracer into the bloodstream. The radiotracer travels through the area under examination. It gives off radiation in the form of gamma rays, which are detected by a gamma camera. This information goes to a computer, which creates images of your bones.
- PET/CT: (https://www.radiologyinfo.org/en/info/pet) Doctors use PET/CT scanning to see if prostate cancer has returned (recurred). Like Bone Scan, PET/CT injects a radiotracer into the bloodstream. The radiotracer attaches to proteins on the surface of prostate cancer cells or is taken up by cancer cells for metabolism.

How is prostate cancer treated?

There are many treatment options for cancer limited to the prostate gland. You and your doctor should carefully consider each option. Weigh the benefits and risk as they relate to the aggressiveness and/or stage of the cancer as well as your age, overall health, and personal preferences. Standard treatments include:

- **Surgery (radical prostatectomy):** The surgeon makes an incision in the lower abdomen or through the perineum (between the anus and the scrotum) and removes the prostate. If they cannot remove the entire tumor, you may need radiation therapy (http://www.radiologyinfo.org) . You will need to keep a urinary catheter in place for several weeks after the procedure. Possible side effects can include incontinence (http://www.radiologyinfo.org) and impotence (http://www.radiologyinfo.org) . Some surgeons may use three small incisions to do robot-assisted prostatectomy via tubes called laparoscopes. This may result in a shorter hospital stay and quicker recovery. This procedure may be preferable for some patients, but not for all.
- External beam therapy (EBT): (https://www.radiologyinfo.org/en/info/ebt) EBT delivers a beam of high-energy x-rays

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(photons) or protons from an external source to the tumor. A machine (linear accelerator) generates and targets the radiation beam at the tumor site. EBT destroys cancer cells, and conformal treatment plans spare surrounding normal tissues from exposure.

- **Active surveillance:** No treatment, with careful observation and medical monitoring.

Advanced treatment options may avoid or minimize some of the side effects associated with standard therapies. These options include:

- **Nerve-sparing radical prostatectomy:** The surgeon removes the prostate without severing the critical nerves that enable sexual function. A skilled, experienced surgeon may be able to preserve sexual function for some patients using this procedure.
- **Intensity modulated external beam radiation therapy (IMRT):** External beam radiation therapy uses high energy radiation beams to kill cancer cells. IMRT uses advanced technology to target radiation to body structures. The doctor uses computerized three-dimensional images of the prostate, bladder, and rectum to shape and conform the radiation to the tumor. They may also target nearby lymph nodes. In this way, less radiation reaches the surrounding normal tissues. IMRT delivers a higher radiation dose to the tumor while protecting healthy nearby organs. Doctors consider IMRT to be more precise and conformal to the volume being targeted. They typically provide IMRT daily (Monday through Friday) for four to nine weeks. *For more detailed information see the IMRT page (https://www.radiologyinfo.org/en/info/imrt)* .
- Stereotactic Body Radiation Therapy (SBRT) (https://www.radiologyinfo.org/en/info/stereotactic) uses photon therapy at a much larger dose per treatment. SBRT treats prostate cancer over one to two weeks with four to five treatments. It requires higher precision and requires special equipment. Not all patients are candidates for SBRT.
- ***Focal therapy:*** Focal therapy is an emerging treatment option that uses various types of thermal energy (laser, cryotherapy, high intensity focused ultrasound (HIFU), focal transurethral ultrasound ablation (TULSA) to treat prostate cancer. The treatment uses minimally invasive approaches to target the tumor while avoiding surrounding healthy tissue. Results depend on careful patient selection.
  - Cryotherapy: (https://www.radiologyinfo.org/en/info/thermal-ablation-therapy) This procedure uses extremely low temperatures (-190°C) to freeze and destroy cancer cells. Some patients get good results and have few complications with cryotherapy. Others do not. Cryotherapy is an alternative to surgery for patients whose prostate cancer has returned after radiation treatment.
- Image-guided radiation therapy (IGRT): (https://www.radiologyinfo.org/en/info/igrt) IMRT, SBRT and proton therapy use daily image guidance (via X-ray, ultrasound, CT, or MRI) to improve treatment setup. This is necessary because of organ movement. Depending on how full your bladder and rectum are, the prostate position can vary. So, the doctor must locate and verify the prostate's position before each treatment. One method places several fiducial markers (https://www.radiologyinfo.org/en/info/fiducial-marker) in the prostate gland for daily treatment localization. Doctors take digital x-ray images to locate the metallic markers. This allows them to check the position of the prostate daily just before the treatment. Another method uses ultrasound to locate the prostate before each treatment. The patient keeps his bladder as full as possible to produce a good ultrasound image. This also moves the bladder out of the radiation treatment field. Other methods use computed tomography (CT) and/or MRI scanning before each treatment to verify prostate position. The type of IGRT you receive will depend on your case and what technology is available at your treatment center.
- Brachytherapy: (https://www.radiologyinfo.org/en/info/brachy) Brachytherapy may be temporary or permanent. Talk to your radiation oncologist (http://www.radiologyinfo.org) about the specifics of your treatment.
  - Temporary implant brachytherapy (http://www.radiologyinfo.org) places radioactive material inside a catheter for a specific amount of time and then removes it. This is also known as high-dose rate (HDR) brachytherapy (http://www.radiologyinfo.org) .
  - Permanent seed implant brachytherapy (http://www.radiologyinfo.org) is also called seed implantation. It permanently places radioactive seeds (about the size of a grain of rice) in or near the tumor. After several months, the seeds lose their radioactivity. This is also known as low dose rate (LDR) brachytherapy. Sometimes, active seeds may trigger radiation detectors at security checkpoints. You may need a doctor's note to explain your situation to security personnel. Inactive seeds are harmless and rarely trigger metal detectors.

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- **Radium 223 treatment:** Xofigo (pronounced zoh-fee-go) is a brand name for Radium 223. Doctors use this isotope to treat prostate cancers that have spread to the bones. Bone cells absorb radium because it chemically resembles calcium. Cancer cells are more active than normal bone cells, so they are more likely to absorb the isotope. The isotope releases radiation within a very small area. It kills the nearby cancer cells while sparing the surrounding, healthy bone cells. Radium 223 effectively controls advanced prostate cancer and reduces pain in more than one area because it travels throughout the body. The injection takes up to a minute. The doctor will typically repeat injection every four weeks for up to six or more total treatments. This an outpatient procedure, so you may return home afterwards. Treatment side effects include diarrhea, anemia, and pain around the tumor. Radium treatment may cause sperm damage. Therefore, men who receive it shouldn't father children for at least six months.

Are there any new developments in the imaging and treatment of prostate cancer?

Doctors often successfully treat prostate cancer. Sometimes, however, the disease returns (recurs). FDA-approved radiotracers for PET/CT called Ga 68 PSMA-11 and Pylarify® (piflufolastat F18), Axumin® (fluciclovine F-18 help detect and locate cancer that recurs following radiation therapy or surgery. Prostate-specific membrane antigen (PSMA) is a protein that helps develop prostate cancer. A PSMA scan uses PET imaging and a radiotracer to locate recurrent or metastatic cancer. Both Ga 68 PSMA-11 and Pylarify® (piflufolastat F18) PSMA PET tracers are also FDA approved to detect if the cancer has spread to other parts of the body in patients with prostate cancer diagnosis and can otherwise be cured by surgery or other types of treatment.

Conventional imaging, such as MRI or ultrasound, cannot locate recurring prostate cancer when it is small. PET/CT with Ga 68 PSMA-11, Pylarify® (piflufolastat F18) and Axumin® can detect recurring cancer when PSA levels are low and when the cancer is small.

Identifying the exact location and extent of the disease at an early state is vital. It allows doctors to specifically target the cancer and limit exposure to healthy tissues.

FDA recently approved PSMA directed therapy using Pluvicto® (Lutetium-177 vipivotide tetraxetan also known as Lu-177 PSMA-617) in adult patients to treat a certain type of advanced metastatic castration resistant prostate cancer that is positive on PSMA PET scans and has spread to other parts of the body (metastasis).

Patients with prostate cancer that has spread to only a few sites in the body (typically defined as less than five sites of spread) are known to have oligometastatic prostate cancer (oligo meaning few, metastases meaning spread of tumor outside the prostate). Patients with oligometastatic prostate cancer may benefit from prostatectomy or radiation therapy. In addition, patients may also benefit from localized treatments such as radiation, surgery, or radiofrequency ablation.

Which test, procedure or treatment is best for me?

- Pretreatment Detection, Surveillance, and Staging of Prostate Cancer (https://www.radiologyinfo.org/en/info/acs-prostate-cancer-detection-surveillance-staging)
- Post-treatment Follow-up of Prostate Cancer (https://www.radiologyinfo.org/en/info/acs-followup-prostate-cancer)

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