Prostate Cancer
Definition & Prevalence

What is prostate cancer?

The prostate is a glandular organ found only in males, which means that only men can develop prostate cancer. Cancer occurs when normal cells start growing and multiplying without their normal control.

Once the cells undergo conversion, they multiply and form a mass referred to as a tumor. Because of their uncontrolled growth, tumors may invade neighboring tissues and reach other organs through the bloodstream, where they can become cancerous (malignant). The process by which tumors can invade and spread to other organs is called metastasis. Tumors overwhelm surrounding tissues by invading their space and taking the oxygen and nutrients they need to survive and function.

Almost all prostatic cancers are prostatic adenocarcinomas, which means that they arise from the secretory glandular cells in the prostate.

> *If prostate cancer is detected early — when it is still confined to the prostate gland — you have a better chance of successful treatment.*

How common is prostate cancer?

In the United States, cancer of the prostate is a common malignancy in men, second only to lung cancer. Each year about 200,000 new cases are diagnosed and about 30,000 men die of the disease[1].

Prostate cancer is the second leading cause of cancer death in men, surpassed only by lung cancer.

Prostate cancer occurs in 1 in 6 men. Reports of diagnosed cases have risen rapidly in recent years and mortality rates are declining, which may be due to increased screening and earlier detection.

The risk of developing prostate cancer rises significantly with age, and 60% of newly diagnosed cases occur in men over the age of 70.

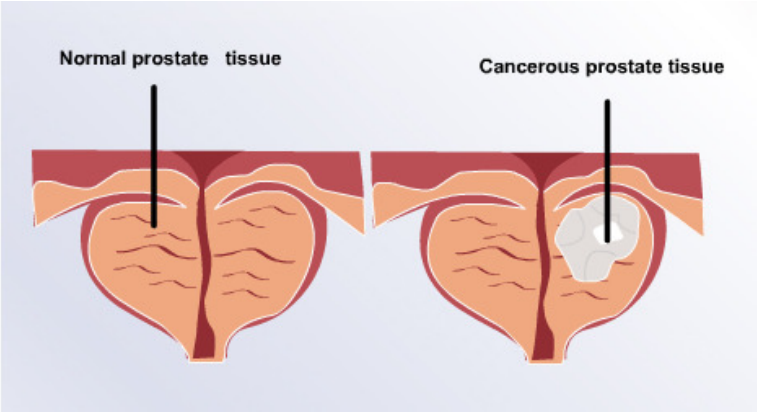


Illustration of Prostate Cancer
This Illustration shows how the tumor gradually increases in size inside the prostatic tissue in comparison to a normal-sized prostate. The tumor has a cotton-like appearance and is an amorphous mass with an uneven profile, which is a reflection of the arbitrary growth of the cells.

Prostate Cancer
Anatomy & Function of the Prostate Gland

What is the normal anatomy of the prostate gland like?

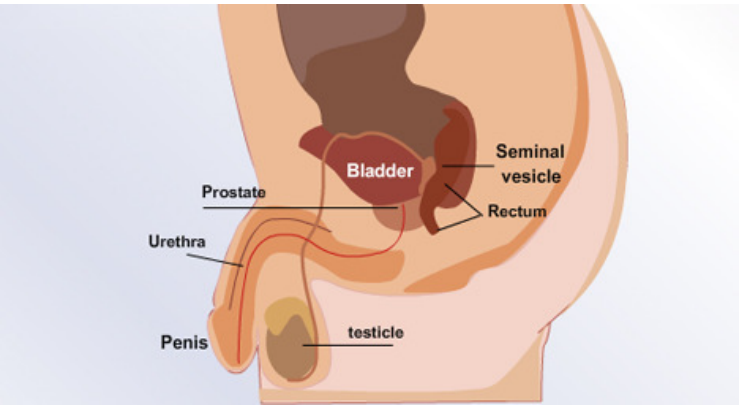
The prostate gland is one of the sex glands of the male reproductive system, also composed of testes, scrotum, penis and other accessory ducts and organs.
The prostate is a small, squishy gland – normally about the size of a walnut – and lies at the neck of the bladder and in front of the rectum. It surrounds the urethra, which is a tubular structure that runs directly through the prostate, and the length of the penis and carries semen and urine out of the penis. It produces a thin, milky fluid that is added to the sperm at the time of ejaculation.

The seminal vesicles sit just above the prostate. These are two small glands that secrete about 60% of the substances that make up semen. Running alongside and attached to the sides of the prostate are the nerves that control erectile function.

How does the prostate work?

Under normal circumstances, the urinary sphincters, bands of muscle tissue at the base of the bladder and at the base of the prostate, remain tightly shut, thereby preventing urine that is stored in the bladder from leaking out. During urination, the sphincters are relaxed and the urine flows from the bladder through the urethra and out of the body[2].
Scientists do not yet know all the functions of the prostate. As part of the male reproductive system, one of its main roles is to squeeze a milky fluid into the urethra as sperm move through during sexual climax.

The prostate fluid, which helps to make up semen, energizes the sperm, forms the main bulk of the ejaculate volume and makes the vaginal canal less acidic.



Etiology & Risk Factors

What causes abnormal growth of a cell?

During cancer progression, abnormal cells refuse to die, and consequently grow more rapidly than their neighboring cells. What causes prostate cancer and why some types of cells behave differently remains unknown. Research suggests that, like many other types of cancer, prostate cancer is a multifactorial disease in which a combination of issues may play a role, including hereditary factors, ethnicity, hormones, diet and the environment[3].

What factors may contribute to prostate cancer?

- Age: After age 50 the chance of developing cancer increases. The incidence of prostate cancer increases steadily from less than 1 in 100,000 for men aged 40 years to 1,146 per 100,000 in men aged 85 years. The median age at prostate cancer diagnosis is 70.5 years. More than 80% of prostate cancers are diagnosed in men older than 65 years. In men older than 90 years at least one cancerous area is found in their prostate.

- Ethnicity: African American men are 1.5-2 times more likely than Caucasian men to develop prostate cancer, and they may also develop prostate cancer at an earlier age. The rapid onset of the disease has also been associated with higher rates of mortality (2.5-fold) compared with that for Caucasians.

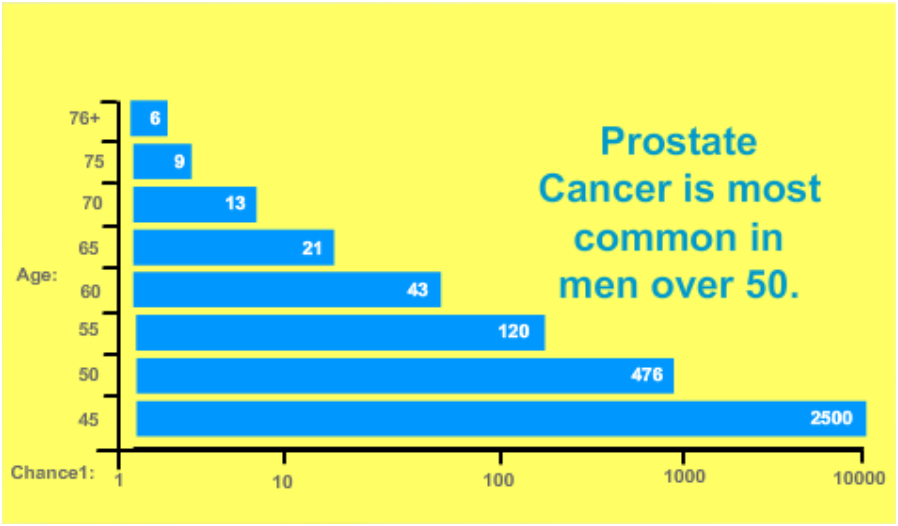
- Hereditary factors: Men with a history of prostate cancer in their family, especially if it was a first-degree relative such as a father or brother, are at an increased risk. This risk may be 2-3 times greater than the risk for men without a family history of the disease. Men with two or more relatives with a

history of prostate cancer are nearly four times as likely to be diagnosed with the disease. The risk is even higher if the affected family members were diagnosed at a young age, with the highest risk seen in men whose family members were diagnosed before age 60.

- Dietary habits: A high-fat diet has been associated with an increased risk of prostate cancer.

> *Recent research has shown that dietary modification might:*
>
> • *Decrease the chances of developing prostate cancer*
>
> • *Reduce the likelihood of having a prostate cancer recurrence*
>
> • *Help slow the progression of the disease*

- Chemical agents: Exposure to chemicals such as cadmium has been implicated in the development of prostate cancer.



Risk of Being Diagnosed with Prostate Cancer

Prostate Cancer Symptoms.

What are the symptoms of prostate cancer?

Most men with prostate cancer have no symptoms, and this particularly true in the preliminary stages of the disease. This means that many cases of prostate cancer are not detected until the cancer has spread beyond the prostate.

When signs and symptoms do occur, their characteristics depend on how advanced the cancer is and how far the cancer has spread. If the cancer is caught

at its earliest stages, most men will not experience any symptoms. Symptoms usually appear when the tumor causes some degree of urinary blockage at the bladder neck or the urethra. These include:

- A need to urinate frequently, especially at night
- Difficulty in starting and stopping the urinary stream, increase in frequency of urination, and pain while urinating
- Weak or interrupted flow of urine (urinary retention). The urinary stream may be diminished, or urine may simply dribble out. Even once voiding ends, there is a sense of bladder fullness because it has not been completely emptied.

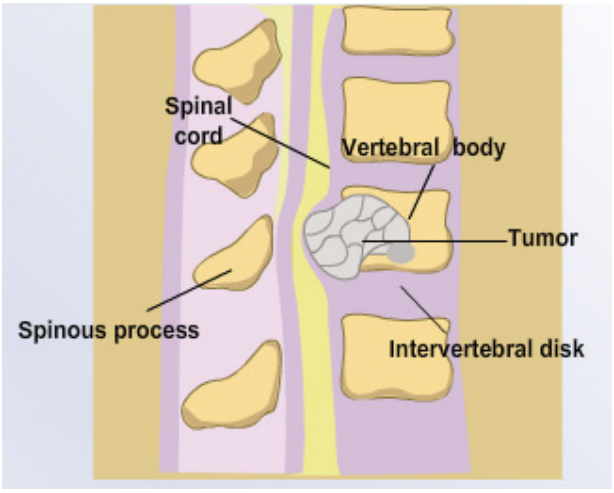
However, these symptoms appear more commonly in men with prostate problems (benign prostatic hyperplasia) or in prostate infections.

When it reaches a more advanced stage, the cancer in the prostate or the area around the prostate can cause blood in the urine or semen, painful ejaculation, painful or burning urination or erectile dysfunction.

If prostate cancer has spread to the lymph nodes located in the pelvis, it may cause frequent pain or stiffness in the lower back, hips or upper thighs, and discomfort in the pelvic area.
As the cancer advances and causes a greater blockage, bladder function may further deteriorate. Men with such advanced cancers sometimes experience recurring urinary tract infections. Advanced prostate cancer that has spread to the bones can cause a very persistent bone pain, mainly in the hips and back, bone fractures from weakening of the bone, and compression of the spine.

Spinal cord compression is a real medical emergency and can appear as the first sign of cancer. In this case, the cancer has spread to the vertebrae and tailbone region, and the weakened vertebrae can cause pressure on the spinal cord, causing symptoms and problems with function.

Spinal Cord Compression



Prostate Cancer Symptoms.

When should you seek medical help?

Despite these symptoms, many men do not seek medical help until the cancer has spread. You should see your health care provider if you have any of the following symptoms[4]:

- Difficulty at initiating and/or stopping a urine stream
- Frequent urination
- Pain on urination or ejaculation

> *The American Cancer Society recommends having yearly screening tests for prostate cancer beginning at age 50.*

You should undergo regular screening for prostate cancer if:

- You are aged 50 or older
- You are considered in the high-risk group, such as those with a family history of prostate cancer or of African American ethnicity, who should begin screening as early as age 40 years.

You should see your doctor immediately or go straight to the emergency department of the nearest hospital if you have any of the following symptoms:

- Urinary tract infection. This causes a burning pain on urination, urgency, frequent urination, especially with fever
- Not urinating or urinating a very small amount despite drinking enough fluid (this could be due to bladder obstruction or kidney failure)
- Spinal compression causing serious back pain. Failure to be treated immediately can result in permanent spinal cord damage

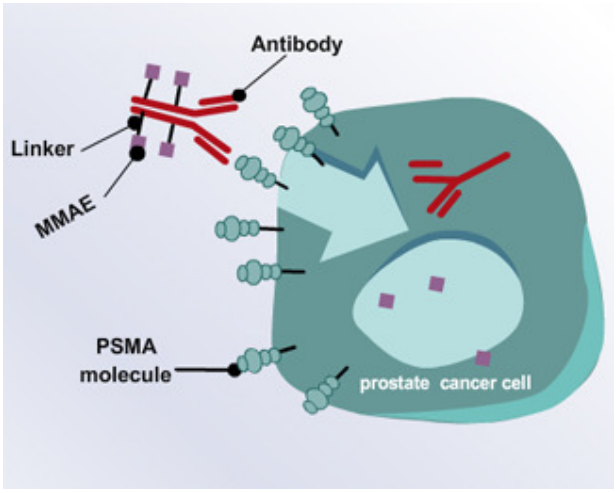
Prostate Cancer Diagnosis. Exams & Tests

What is rapid screening?

The purpose of screening for cancer is to detect the cancer at its earliest stages, before any symptoms have developed. Yearly prostate cancer screening can be performed quickly and can easily help detect prostate cancer early, when it is easier to treat. Screening includes a blood test to measure PSA (prostate-specific antigen) and a digital rectal exam (DRE)[5].

- PSA Test. Prostate-specific antigen is a prostatic protein which circulates in the bloodstream in very small amounts. When there is a problem with the prostate (enlargement, infection, inflammation, cancer) this protein is released in high amounts into the blood. The amount of protein is higher for as long as the prostate deteriorates. During a PSA test, a small amount of blood is drawn from the arm, and the PSA level is measured. PSA levels < 4 ng/mL are usually considered normal, whereas results > 10 ng/mL are usually considered to be high.

- Digital Rectal Exam. During a DRE, the physician inserts a gloved, lubricated finger into the rectum and examines the prostate for any irregularities in size, shape or texture. Often the DRE can be used by urologists to help distinguish between prostate cancer and noncancerous conditions such as benign prostatic hyperplasia. While it can be slightly uncomfortable, an annual DRE is a quick, simple exam that can be a lifesaver.

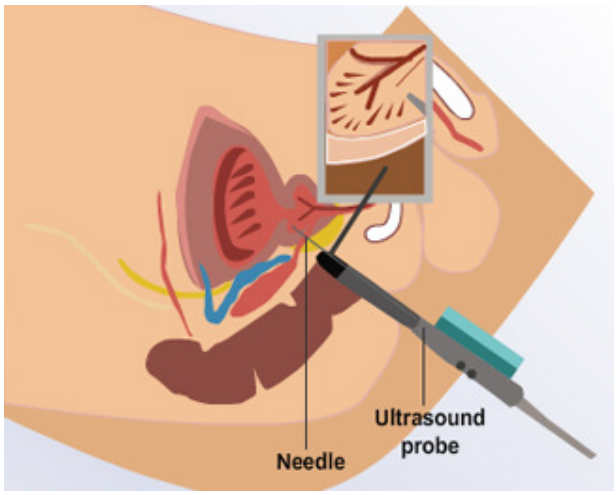


Prostate Cancer
Diagnosis.
Exams & Tests

How to grade the aggressiveness of prostate cancer?

- Biopsy

Although the DRE and PSA tests cannot diagnose prostate cancer per se, they can indicate the need for a biopsy to examine the prostate cells and determine whether they are cancerous. During a biopsy, with the guidance of ultrasound imaging, needles are inserted into the prostate to take small samples of tissue. The biopsy procedure may cause some discomfort or pain, but the procedure is short, and can usually be performed without an overnight hospital stay.
After the biopsy, a pathologist who specializes in diagnosing cancer and other tissue abnormalities evaluates the samples. Based on the microscopic analysis, the pathologist will determine whether or not the tissue removed is cancerous and if it is, will estimate how aggressive it is. To predict the aggressiveness of the disease and how it will behave, pathologists use the Gleason score. The higher the Gleason score, the more abnormal the cell population in the prostate, and the more likely it is to spread quickly.



Prostate Cancer Diagnosis. Exams & Tests

Examining the extent of the disease.

A number of measures are used to determine the extent of prostate cancer. Localized prostate cancer means that the cancer is confined within the prostate. Locally advanced prostate cancer means that some tumor cells have started to infiltrate the immediate surrounding tissues. In metastatic disease, the prostate cancer is growing outside its immediate environs, possibly to more distant organs.
Your doctor may need further tests to evaluate how far the cancer has progressed[6]:

- Bone scan. This test is like an X-ray film of the entire body that highlights areas where the cancer has affected the bones. A bone scan allows the specialist to determine whether cancer has spread to any bones in the body, not just those closest to the prostate, such as the pelvis or lower spine.

- Ultrasound. Ultrasound may also reveal whether the disease has spread to nearby tissues. For instance, renal ultrasonography can be used to look for the effects of a urinary blockage on the kidneys.

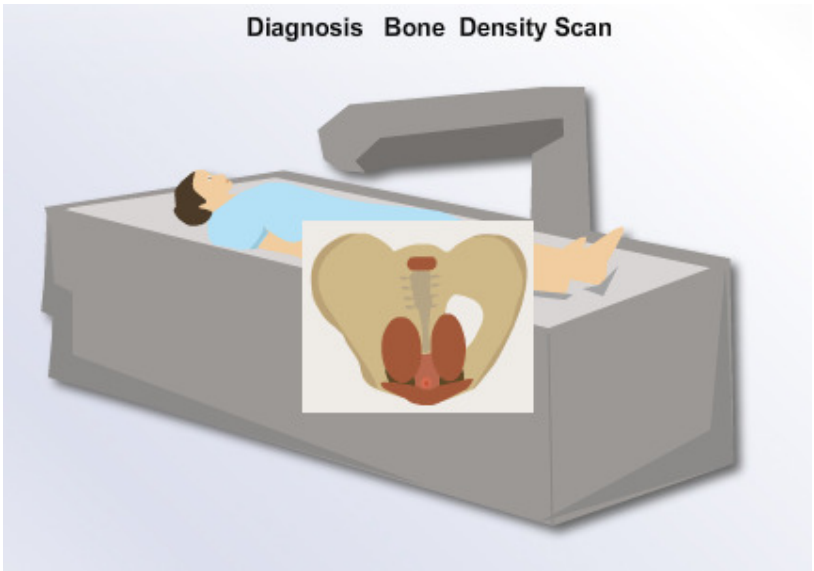
- Computed tomography (CT) scan. This is the best way to detect the extent of the primary cancer as well as distant metastases. A CT scan produces cross-sectional images of your body. CT scans are normally taken from the

abdomen and pelvis and can identify enlarged lymph nodes or abnormalities in other organs.

- Magnetic resonance imaging (MRI). Through a complex combination of waves and magnets, this type of imaging produces detailed cross-sectional pictures of your body. An MRI can help detect evidence of the possible spread of cancer to lymph nodes and bones.
- Lymph node biopsy. When enlarged lymph nodes are identified on a CT scan or an MRI, a lymph node biopsy can determine whether cancer has spread to nearby lymph nodes.
- Cystoscopy. This is an endoscopic test. A thin, flexible tube equipped with a light and tiny camera on the end is inserted through the urethra to the bladder. The camera transmits images to a video monitor. This shows whether the cancer has spread to the urethra or bladder.

Metastatic disease can be identified using imaging tests

Diagnosis Bone Density Scan



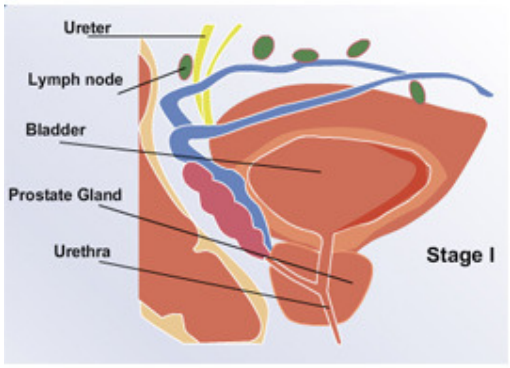
Prostate Cancer
Stages and Complications of Prostate Cancer
Stages of the disease

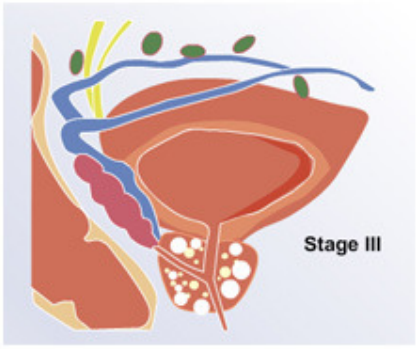
If the biopsy results are positive for cancer, further staging procedures will be done. Staging is a system of classifying tumors by size, location and extent of the spread, local and remote, and is also a good indicator for prognosis.
Prostate cancers are also assigned a grade, which indicates how different the cancer cells are from normal prostate tissue. Grade gives an indication of how fast a cancer is likely to grow.
The cancer is assigned one of four stages, based on how far it has spread.
The stages of prostate cancer are as follows:

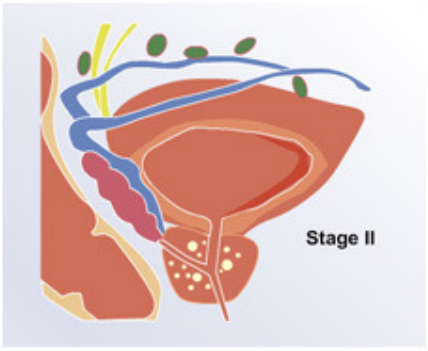
- **Stage I (or A)**: The cancer is difficult to detect by digital rectal exam, and there is no evidence that it has spread outside the prostate. Tumors at this stage are often found incidentally during surgery for an enlarged prostate. This is cancer in its very early stages, when it is localized to a microscopic area.
- **Stage II (or B)**: In this case, the tumor is larger and can be felt on digital rectal exam. There is no evidence that the cancer has spread outside the prostate. This is usually identified on biopsy when a man has an elevated PSA level.
- **Stage III (or C)**: The cancer has invaded other tissues neighboring the prostate (seminal vesicles or other nearby tissues).
- **Stage IV (or D)**: The cancer has spread to lymph nodes, bones, lungs or to other organs.

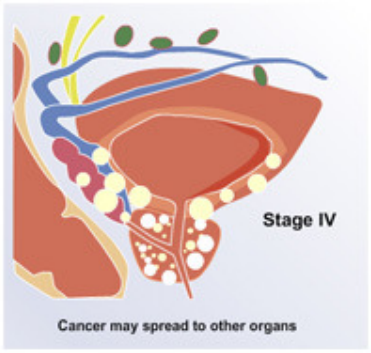
Knowing the stage of disease can help to determine how aggressively the disease needs to be treated, and how likely it is to be eradicated by the available treatment options.

Staging the Prostate Cancer Urethra









Prostate Cancer
Treatment of Prostate Cancer.

Medical Options for the Treatment of Prostate Cancer

There is no “one size fits all” treatment for prostate cancer. Several treatments are available.
The choice of treatment depends on age, general medical condition, life expectancy, how fast the cancer is growing and how much it has spread, as well as the benefits and the potential side effects of the treatment.
A treatment plan should be individualized for each patient, depending on his feelings about the different treatments and their potential side effects.
Medical options to treat prostate cancer are the following[7]:

- **External beam radiation therapy (EBRT)**

  External beam radiation treatment uses high-powered X-rays to kill cancer cells. However, this type of radiation is effective at extinguishing cancerous cells, but also neighboring healthy tissue. Firstly, computer-imaging software maps the precise area of the body that needs to receive radiation. Focused radiation kills prostate tumor cells while minimizing harm to surrounding tissue. EBRT can cause mild side effects (rectal urgency, frequent urination and urinary urgency), but in most cases they disappear shortly after the treatment course is finished.

- **Radioactive seed implants (brachytherapy)**

  In recent years, radioactive seeds containing iodine and palladium implanted into the prostate have become a treatment option for prostate cancer. Implants deliver high doses of radiation over a long period of time. The therapy is generally used in men with smaller or moderate-sized prostates with small and lower grade cancers. During the procedure, between 40 and 100 rice-sized radioactive seeds are placed in the prostate through ultrasound-guided needles. These seeds do not have to be removed after they stop emitting radiation. Urinary problems (painful urination), erectile dysfunction, or rectal symptoms (loose stools, discomfort) are normal side effects of this type of therapy.

- **Hormone therapy**

  Hormone therapy consists of stopping the synthesis of testosterone (a male hormone), which can stimulate the growth of cancer cells. This type of

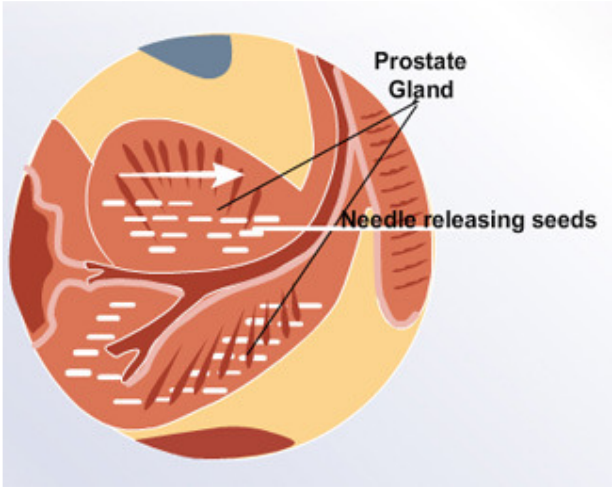
therapy can also block hormones from entering cancer cells. Hormones are normally used when prostate cancer is advanced, since they are effective in helping both shrink the cancer and slow the growth of tumors. However, sometimes hormone therapy is used in early-stage cancers to shrink large tumors so that surgery or radiation can remove or destroy them more easily. In some cases, hormone therapy is used in combination with radiation therapy or surgery.

In prostate cancer hormone therapy, LHRH (luteinizing hormone-releasing hormone) agonists and antagonists are used to prevent the pituitary gland from releasing LH. The levels of testosterone will drop 90–95% to reach what is called castration level. The use of an LHRH agonist or antagonist in prostate cancer hormone therapy is therefore often called chemical castration. LHRH is also referred to as gonadotropin hormone-releasing hormone. A luteinizing hormone-releasing hormone (LHRH) agonist, such as leuprolide, goserelin or buserelin stops the production of testosterone.

Injections of estrogen, a female hormone, can also be used to suppress testosterone.

Side effects of these medications can vary. LHRH agonists may cause impotence, hot flashes and loss of sexual desire. Antiandrogens may cause nausea, vomiting, diarrhea and breast enlargement or tenderness. Any of these therapies can weaken bones.

Treatment. Seed implants (Brachitherapy)



Prostate Cancer
Treatment of Prostate Cancer.
Surgical Options to Treat Prostate Cancer

➢ Radical prostatectomy

This consists of the surgical removal of the entire prostate. This operation is indicated for cancer that is limited to the prostate and has not invaded the capsule of the prostate, any other nearby structures or lymph nodes, or distant organs. The entire prostate, seminal vesicles, and ampulla of the vas deferens are removed, and the bladder is connected to the membranous urethra to allow free urination. Radical prostatectomy can be combined with radiation therapy in men with cancer that is even further isolated in the prostate area. There is an excellent survival rate if cancer has not spread.

Complications of this procedure include urinary incontinence and impotence.

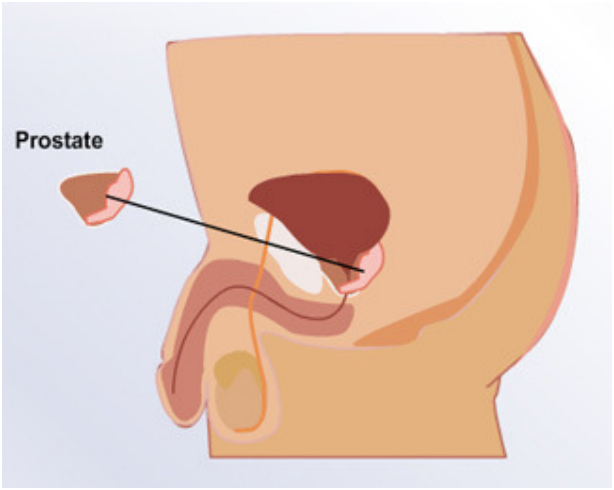
➢ Robot-assisted laparoscopic radical prostatectomy (RALRP)

This is an assisted laparoscopic instrument that allows the surgeon to spare the nerve that controls urination and erection. Despite a scarcity of outcome data, it has been shown that, of the men that undergo these newer techniques, 98% are continent and 60% are able to have an erection.

➢ Transurethral resection of the prostate (TURP)

This is an alternative to prostatectomy. An instrument inserted through the urethra removes part of the prostate by using an electric current emitted from the end of the instrument. This is used in early stage disease to remove tissue that is blocking urination.

Treatment Prostatectomy



Prostate Cancer
Treatment of Prostate Cancer.

Chemotherapy to Treat Prostate Cancer

Chemotherapy should be considered as the last option to be used against prostate cancer. This type of treatment uses chemicals that destroy rapidly growing cells. Chemotherapy can be quite effective in treating prostate cancer, but it will never cure it.

Chemotherapy has not been shown to significantly prolong survival. Research studies have shown that adding chemotherapy to other treatments has also failed to prolong survival.

Chemotherapy is very toxic and tends to have many side effects, even more than those attributed to hormones. It is only reserved for those cases where hormone-resistant prostate cancer has been demonstrated.

Other therapies

- **Cryotherapy**

  This technique involves inserting a probe through a small skin incision in the perineum (between the rectum and the scrotum) and freezing areas of cancer in the prostate. This therapy is reserved for cancer localized within the prostate as well as for men who are unable to withstand the conventional therapies such as surgery or radiation.

  Cryotherapy has several advantages over surgery and radiation therapy. There is less bleeding, earlier hospital discharge, shorter recovery times,

and less pain than with conventional surgery. Since this is a newer treatment option, the long-term efficacy is still unknown.

➢ Gene therapy and immune therapy

Although progress continues, more time is needed to determine how successful these new therapies may be as treatment for prostate cancer. Due to current technology, the use of these experimental treatments is limited to a small number of medical centers.

Prostate Cancer
Complications of Prostate Cancer

Complications from prostate cancer may arise and are normally due to the cancer itself or to the treatment. Urinary incontinence and erectile dysfunction are some of the greatest fears of many men who have prostate cancer. Fortunately, therapies exist to help cope with or treat these conditions.
The typical complications of prostate cancer and its treatment include[8]:

➢ Spread of cancer (metastases)

Prostate cancer can metastasize to nearby organs, bones, lungs or the lymph nodes. Treatments for prostate cancer that has spread can include hormone therapy, radiation therapy and chemotherapy.

➢ Pain

Once cancer has reached the bones, the clinical situation is completely different for the patient and it becomes a very painful condition. Treatments directed at shrinking the cancer can often produce significant pain relief.

➢ Difficulty urinating (urinary incontinence)

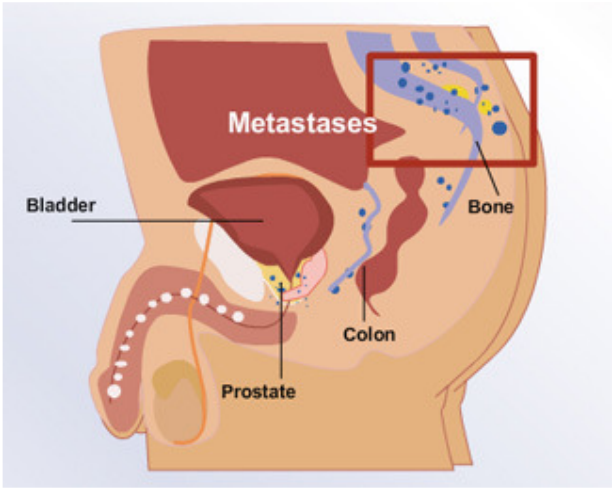
Both prostate cancer and its treatment can cause incontinence. Treatment depends on the type of incontinence, its severity and the likelihood it will improve over time. Treatments include behavior modification, exercises to strengthen pelvic muscles, medications and catheters.

➢ Erectile dysfunction or impotence

Like incontinence, erectile dysfunction can be a result of prostate cancer or its treatment, including surgery, radiation or hormone treatments. Some drugs together with vacuum devices that assist in achieving erection are available to treat erectile dysfunction.

➢ Depression

Many men may feel depressed after being diagnosed with prostate cancer or after trying to cope with the side effects of treatment. Treatment such as counseling or antidepressants can make a large difference.



Prostate Cancer
Prevention & Follow-Up

Is prostate cancer really a preventable disease?

Of course not. Prostate cancer cannot be prevented, but several measures can be taken to reduce the risk or to delay the disease progression.
However, because diet has been implicated as a potential cause, having a healthy lifestyle may provide some protection.

➢ Proper nutrition

Reducing the intake of fatty foods and increasing the amount of fruit, vegetables, and grains, may help decrease risk of prostate cancer. Garlic, arugula, bok choy, broccoli, Brussels sprouts, cabbage and cauliflower may also help fight cancer

Eating certain foods that contain substances called antioxidants (vitamins C and E and beta carotene) may be protective (tomato, grapefruit, watermelon).

Some research suggests that taking vitamin E, an antioxidant, may reduce the risk of not only prostate cancer but also other solid organ tumors. However, this theory remains unproven.

➢ Regular exercise

Exercise as much as possible. Exercise may reduce the risk of prostate cancer and strengthen the immune system, improve circulation and speed up digestion — all of which may play a role in cancer prevention.

Regular exercise plays an important role in the prevention of prostate gland enlargement, as well as benign prostatic hyperplasia.

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