Radiation Therapy for Prostate Cancer

Radiation therapy uses high-energy rays or particles to kill cancer cells.

When is radiation therapy used?

Radiation may be used:

- As the first treatment for cancer that is still just in the prostate gland and is low grade (/cancer/prostate-cancer/detection-diagnosis-staging/how-diagnosed.html). Cure rates for men with these types of cancers are about the same as those for men treated with radical prostatectomy (/cancer/prostate-cancer/treating/surgery.html).
- As part of the first treatment (along with hormone therapy) for cancers that have grown outside the prostate gland and into nearby tissues.
- If the cancer is not removed completely or comes back (recurs) in the area of the prostate after surgery.
- If the cancer is advanced, to help keep the cancer under control for as long as possible and to help prevent or relieve symptoms.

Types of radiation therapy

The 2 main types of radiation therapy used for prostate cancer are:

- External beam radiation
- Brachytherapy (internal radiation)

(Another type of radiation therapy, in which a medicine containing radiation is injected into the body, is described in Preventing and Treating Prostate Cancer Spread to the Bone (/cancer/prostate-cancer/treating/treating-pain.html).)

External beam radiation therapy (EBRT)

In EBRT, beams of radiation are focused on the prostate gland from a machine outside the body. This type of radiation can be used to try to cure earlier stage cancers, or to help relieve symptoms such as bone pain if the cancer has spread to a specific area of bone.

Before treatments start, your radiation team will take careful measurements to find the correct angles for aiming the radiation beams and the proper dose of radiation. This planning session, called *simulation*, usually includes getting imaging tests such as CT (/treatment/understanding-your-diagnosis/tests/ct-scan-for-cancer.html) or MRI (/treatment/understanding-your-diagnosis/tests/mri-for-cancer.html) scans. You might be fitted with a plastic mold resembling a body cast to keep you in the same position for each treatment so that the radiation can be aimed more accurately.

You will usually be treated 5 days a week in an outpatient center for at least several weeks, depending on why the radiation is being given. Each treatment is much like getting an x-ray. The radiation is stronger than that used for an x-ray, but the procedure is painless. Each treatment lasts only a few minutes, although the setup time — getting you into place for treatment — takes longer.

Newer EBRT techniques focus the radiation more precisely on the tumor. This let doctors give higher doses of radiation to the tumor while reducing the radiation exposure to nearby healthy tissues.

Three-dimensional conformal radiation therapy (3D-CRT)

3D-CRT uses special computers to precisely map the location of your prostate. Radiation beams are then shaped and aimed at the prostate from several directions, which makes it less likely to damage normal tissues.

Intensity modulated radiation therapy (IMRT)

IMRT, an advanced form of 3D therapy, is the most common type of EBRT for prostate cancer. It uses a computer-driven machine that moves around the patient as it delivers radiation. Along with shaping the beams and aiming them at the prostate from several angles, the intensity (strength) of the beams can be adjusted to limit the doses reaching nearby normal tissues. This lets doctors deliver an even higher dose to the cancer.

Some newer radiation machines have imaging scanners built into them. This advance, known as **image guided radiation therapy (IGRT)**, lets the doctor take pictures of the prostate and make minor adjustments in aiming just before giving the radiation. This may help deliver the radiation even more precisely, which might result in fewer side effects, although more research is needed to prove this.

Another approach is to place tiny implants into the prostate that send out radio waves to tell the radiation therapy machines where to aim. This lets the machine adjust for movement (like during breathing) and may allow less radiation to go to normal tissues. In theory, this could lower side effects. So far, though, no study has shown side effects to be lower with this approach than with other forms of IMRT. The machines that use this are known as Calypso®.

A variation of IMRT is called **volumetric modulated arc therapy (VMAT)**. It uses a machine that delivers radiation quickly as it rotates once around the body. This allows each treatment to be given over just a few minutes. Although this can be more convenient for the patient, it hasn't yet been shown to be more effective than regular IMRT.

Stereotactic body radiation therapy (SBRT)

This technique uses advanced image guided techniques to deliver large doses of radiation to a certain precise area, such as the prostate. Because there are large doses of radiation in each dose, the entire course of treatment is given over just a few days.

SBRT is often known by the names of the machines that deliver the radiation, such as Gamma Knife®, X-Knife®, CyberKnife®, and Clinac®.

The main advantage of SBRT over IMRT is that the treatment takes less time (days instead of weeks). The side effects, though, are not better. In fact, some research has shown that some side effects might actually be worse with SBRT than with IMRT.

Proton beam radiation therapy

Proton beam therapy focuses beams of protons instead of x-rays on the cancer. Unlike x-rays, which release energy both before and after they hit their target, protons cause little damage to tissues they pass through and release their energy only after traveling a certain distance. This means that proton beam radiation can, in theory, deliver more radiation to the prostate while doing less damage to nearby normal tissues. Proton beam radiation can be aimed with techniques similar to 3D-CRT and IMRT.

Although in theory proton beam therapy might be more effective than using x-rays, so far studies have not shown if this is true. Right now, proton beam therapy is not widely available. The machines needed to make protons are very expensive, and they aren't available in many centers in the United States. Proton beam radiation might not be covered by all insurance companies at this time.

Possible side effects of EBRT

Some of the side effects from EBRT are the same as those from surgery (/cancer/prostate-cancer/treating/surgery.html), while others are different.

Bowel problems: Radiation can irritate the rectum and cause a condition called *radiation proctitis*. This can lead to diarrhea, sometimes with blood in the stool, and rectal leakage. Most of these problems go away over time, but in rare cases normal bowel function does not return. To help lessen bowel problems, you may be told to follow a special diet during radiation therapy to help limit bowel movement during treatment. Sometimes a balloon-like device is put in the rectum during each treatment to keep the bowel as still as possible while treatment is given.

Urinary problems: Radiation can irritate the bladder and lead to a condition called *radiation cystitis*. You might need to urinate more often, have a burning sensation while you urinate, and/or find blood in your urine. Urinary problems usually improve over time, but in some men they never go away.

Some men develop urinary incontinence after treatment, which means they can't control their urine or have leakage or dribbling. As described in the surgery (/cancer/prostate-cancer/treating/surgery.html) section, there are different levels and types of incontinence. Overall, this side effect occurs less often than after surgery. The risk is low at first, but it goes up each year for several years after treatment.

Rarely, the tube that carries urine from the bladder out of the body (the urethra) may become very narrow or even close off, which is known as a *urethral stricture*. This might require further treatment to open it up again.

Erection problems, including impotence: After a few years, the impotence rate after radiation is about the same as that after surgery. Problems with erections usually do not occur right after radiation therapy but slowly develop over time. This is different from surgery, where impotence occurs immediately and may get better over time.

As with surgery, the older you are, the more likely it is you will have problems with erections. Erection problems can often be helped by treatments such as those listed in the surgery (/cancer/prostate-cancer/treating/surgery.html) section, including medicines.

For more about coping with erection problems and other sexuality issues, see Sexuality for the Man With Cancer (/treatment/treatments-and-side-effects/physical-side-effects/fertility-and-sexual-side-effects/sexuality-for-men-with-cancer.html).

Feeling tired: Radiation therapy can cause fatigue (/treatment/treatments-and-side-effects/physical-side-effects/fatigue.html) that might not go away until a few weeks or months after treatment stops.

Lymphedema: The lymph nodes normally provide a way for fluid to return to the heart from all areas of the body. If the lymph nodes around the prostate are damaged by radiation, fluid may collect in the legs or genital region over time, causing swelling and pain. Lymphedema can usually be treated with physical therapy, although it may not go away completely. See our lymphedema (/treatment/treatments-and-side-effects/physical-side-effects/lymphedema.html) page to learn more.

Brachytherapy (internal radiation therapy)

Brachytherapy (also called **seed implantation** or **interstitial radiation therapy**) uses small radioactive pellets, or "seeds," each about the size of a grain of rice. These pellets are placed directly into your prostate.

- Brachytherapy alone is generally used only in men with early-stage prostate cancer that is relatively slow growing (low-grade).

- Brachytherapy combined with external radiation is sometimes an option for men who have a higher risk of the cancer growing outside the prostate.

The use of brachytherapy is also limited by some other factors. For men who have had a transurethral resection of the prostate (TURP) (/cancer/prostate-cancer/treating/surgery.html) or for those who already have urinary problems, the risk of urinary side effects may be higher. Brachytherapy might not work as well in men with large prostate glands because it might not be possible to place the seeds into all of the correct locations. One way to get around this may be to get a few months of hormone therapy (/cancer/prostate-cancer/treating/hormone-therapy.html) beforehand to shrink the prostate.

Imaging tests such as transrectal ultrasound (/treatment/understanding-your-diagnosis/tests/ultrasound-for-cancer.html), CT scans (/treatment/understanding-your-diagnosis/tests/ct-scan-for-cancer.html), or MRI (/treatment/understanding-your-diagnosis/tests/mri-for-cancer.html) are used to help guide the placement of the radioactive pellets. Special computer programs calculate the exact dose of radiation needed.

There are 2 types of prostate brachytherapy. Both are done in an operating room. You will get either spinal anesthesia (where the lower half of your body is numbed) or general anesthesia (where you are asleep), and you might need to stay in the hospital overnight.

Permanent (low dose rate, or LDR) brachytherapy

In this approach, pellets (seeds) of radioactive material (such as iodine-125 or palladium-103) are placed inside thin needles, which are inserted through the skin in the area between the scrotum and anus and into the prostate. The pellets are left in place as the needles are removed and give off low doses of radiation for weeks or months. Radiation from the seeds travels a very short distance, so the seeds can give off a large amount of radiation in a very small area. This limits the amount of damage to nearby healthy tissues.

Usually, around 100 seeds are placed, but this depends on the size of the prostate. Because the seeds are so small, they seldom cause discomfort, and are simply left in place after their radioactive material is used up.

You may also get external beam radiation along with brachytherapy, especially if there is a higher risk that your cancer has spread outside the prostate (for example, if you have a higher Gleason score (/cancer/prostate-cancer/detection-diagnosis-staging/how-diagnosed.html)).

Temporary (high dose rate, or HDR) brachytherapy

This technique is done less often. It uses higher doses of radiation that are left in place for a short time. Hollow needles are placed through the skin between the scrotum and anus and into the prostate. Soft nylon tubes (catheters) are placed in these needles. The needles are then removed but the catheters stay in place. Radioactive iridium-192 or cesium-137 is then placed in the catheters, usually for 5 to 15 minutes. Generally, about 3 brief treatments are given over 2 days, and the radioactive substance is removed each

time. After the last treatment the catheters are removed. For about a week after treatment, you may have some pain or swelling in the area between your scrotum and rectum, and your urine may be reddish-brown.

These treatments are usually combined with external beam radiation given at a lower dose than if used by itself. The advantage of this approach is that most of the radiation is concentrated in the prostate itself, sparing nearby normal tissues.

Possible risks and side effects of brachytherapy

Radiation precautions: If you get permanent (LDR) brachytherapy, the seeds will give off small amounts of radiation for several weeks or months. Even though the radiation doesn't travel far, your doctor may advise you to stay away from pregnant women and small children during this time. If you plan on traveling, you might want to get a doctor's note regarding your treatment, as low levels of radiation can sometimes be picked up by detection systems at airports.

There's also a small risk that some of the seeds might move (migrate). You may be asked to strain your urine for the first week or so to catch any seeds that might come out. You may be asked to take other precautions as well, such as wearing a condom during sex. Be sure to follow any instructions your doctor gives you. There have also been reports of the seeds moving through the bloodstream to other parts of the body, such as the lungs. As far as doctors can tell, this is uncommon and doesn't seem to cause any ill effects.

These precautions aren't needed after HDR brachytherapy, because the radiation doesn't stay in the body after treatment.

Bowel problems: Brachytherapy can sometimes irritate the rectum and cause a condition called *radiation proctitis*. Bowel problems such as rectal pain, burning, and/or diarrhea (sometimes with bleeding) can occur, but serious long-term problems are uncommon.

Urinary problems: Severe urinary incontinence (trouble controlling urine) is not a common side effect. But some men have problems with frequent urination or other symptoms due to irritation of the urethra, the tube that drains urine from the bladder. This tends to be worse in the weeks after treatment and gets better over time. Rarely, the urethra may actually close off (known as a urethral stricture) and need to be opened with a catheter or surgery.

Erection problems: Some studies have found rates of erection problems to be lower after brachytherapy, but other studies have found that the rates were no lower than with external beam radiation or surgery. The younger you are and the better your sexual function before treatment, the more likely you will be to regain function after treatment.

Erection problems can often be helped by treatments such as those listed in the surgery (/cancer/prostate-cancer/treating/surgery.html) section, including medicines. For more about coping with erection problems and other sexuality issues, see Sexuality for the Man With Cancer (/treatment/treatments-and-side-effects/physical-side-effects/fertility-and-sexual-side-effects/sexuality-for-men-with-cancer.html).

To learn more, see the Radiation Therapy (/treatment/treatments-and-side-effects/treatment-types/radiation.html) section of our website.

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