

Prostate Cancer: Causes, Diagnosis and Treatment Options

Causes of Prostate Cancer

While the causes of prostate cancer are largely unknown, it is clear that the chance of developing prostate cancer increases in men over 50. Close relatives of men who have had prostate cancer are also more likely to be affected. Ethnic origin appears to play a part: Men of African heritage are at highest risk, and men of Far-Eastern descent have the lowest risk of developing prostate cancer. It may be possible to reduce the risk by following a low-fat diet and staying in shape. For example, men may reduce their risk through daily exercise and by cutting back on foods high in animal fat.

Diagnosis

Testing a blood sample for the level of Prostate Specific Antigen (PSA) plays an important part in the early detection of prostate cancer. PSA is a substance made by the normal prostate gland. Although PSA is mostly found in semen, a small amount is also present in the blood.

Most men have levels under four nanograms per milliliter (ng/mL) of blood. When prostate cancer develops, the PSA level usually goes above 4; however, a high PSA score does not always indicate cancer.

Although a digital rectal exam (DRE) is less effective than the PSA blood test in finding prostate cancer, this exam can sometimes find cancers in men with normal PSA levels. For this reason, the American Cancer Society guidelines recommend the use of both the DRE and PSA blood test for early prostate cancer detection.

When a physician suspects prostate cancer based on a patient's symptoms, the results of a DRE and/or a PSA, the diagnosis must be made by doing a biopsy. The physician will use transrectal ultrasound (TRUS) for guidance to insert a narrow needle through the wall of the rectum and into several areas of the prostate gland. The needle then removes the cylindrical tissue sample, which is sent to the laboratory to test for cancer.

If the biopsy shows the presence of prostate cancer, the pathologist assigns each tissue sample a grade, indicating how far the cells have traveled along the path from normal to abnormal. A tumor with a low grade is likely to be slow growing, while one with a high grade is more likely to grow aggressively or to already have spread outside the prostate (metastasized).

The most widely used grading method for prostate cancer is known as the Gleason grading system.

Treatment Options

According to statistics collected in the early 1990s, approximately 30 percent of prostate cancer patients in the United States were treated with surgery, 30 percent were treated with radiation and 20 percent elected watchful waiting. Most of the remaining 20 percent were treated with a combination of therapies. In Europe, by contrast, watchful waiting was the standard treatment for asymptomatic prostate cancer.

Radical Prostatectomy

Radical prostatectomy, or surgical removal of the prostate and surrounding cancerous tissues, is considered the "gold standard" or best way to eradicate prostate cancer. Radical prostatectomy is a complex and delicate procedure due to many factors, including the location of the prostate gland deep inside the pelvis. In radical prostatectomy, the surgeon removes the entire prostate gland along with both seminal vesicles, both ampullae (the enlarged lower sections of the vas deferens), as well as

additional surrounding tissues. The section of urethra that runs through the prostate is cut away; with it may also come some of the sphincter muscle that controls the flow of urine.

The popularity of surgery in the United States has grown tremendously in recent decades. A study of Medicare patients' records found that by 1990, the number of U.S. men receiving radical prostatectomy was six times greater than the number recorded for 1984. The increase was seen in all age groups, from the youngest (age 65) to men in their 80s.

The emergence of radical prostatectomy as a preferred prostate cancer treatment has corresponded with wider availability of minimally invasive surgery. Studies show that for many patients, a minimally invasive approach can reduce complications and promote faster recovery times. In the United States today, surgeons use one of three approaches to radical prostatectomy: open surgery, laparoscopic surgery and robotic-assisted laparoscopic surgery, of which the latter two are minimally invasive.

Three Approaches to Radical Prostatectomy: Open, Laparoscopic and Robotic-Assisted Laparoscopic (*da Vinci*[®] Prostatectomy)

An open prostatectomy requires an 8-10 inch incision on the patient's abdomen for direct access to the operative site. Conventional laparoscopic and robotic-assisted laparoscopic approaches require several dime-sized incisions, or operating "ports," which are used to introduce narrow-shafted instruments. The surgeon and assistants maneuver the instruments from outside the body, under vision provided by a surgical camera.

The potential advantages of laparoscopic and robotic-assisted laparoscopic prostatectomy over conventional open surgery include smaller incisions for less post-operative pain and improved cosmetics; reduced blood loss and less need for blood transfusions, as well as a faster return to normal activities.

The two major drawbacks of conventional laparoscopy are that it relies on the use of rigid, hand-held instruments and visualization provided by a standard 2D video monitor. While these technologies enable smaller incisions, they can limit the surgeon's sense of depth of field, his/her dexterity and precision. Standing at the patient's side, the surgeon must operate in a counterintuitive fashion, moving the long-shafted instrument handle in precisely the opposite direction as he or she intends to move the instrument tip. The surgeon maneuvers the instruments while looking up at the 2D view of the operating field projected on a tableside video monitor and while instructing an assistant on how to position the surgical camera.

In contrast, *da Vinci* Prostatectomy (*dVP*) incorporates state-of-the-art robotic technologies that provide natural depth of field and allow a surgeon's hand movements to be scaled, filtered and translated into precise micro-movements of tiny instruments at the operative site. The superior visualization, enhanced dexterity, precision and control enable the surgeon to perform complex procedures – like radical prostatectomy – through dime-sized operating "ports."

For most patients, *da Vinci* Prostatectomy offers substantially less pain and a much shorter recovery than traditional prostate surgery. Other advantages may include reduced need for blood transfusions, less scarring and less risk of infection. In addition, recent studies suggest that *dVP* may offer improved cancer control and a lower incidence of impotence and urinary incontinence.

Due to its obvious advantages, *dVP* has become the fastest growing treatment for prostate cancer in the United States. Moreover, *dVP* has already been used to successfully treat thousands of prostate cancer patients worldwide. This year, it is expected that 20% of all prostatectomies will be performed using this technique, and that this percentage will continue to grow rapidly.

Cryosurgery

Cryosurgery uses liquid nitrogen or argon gas to freeze and kill prostate cancer cells. Guided by a Trans Rectal Ultra Sound (TRUS), the doctor places needles in pre-selected locations in the prostate gland, and then dilates the needle tracks to insert thin, metal cryoprobes through the skin of the perineum

into the prostate. Liquid nitrogen in the probes forms an ice ball that freezes the prostate cancer cells. As the cells thaw, they rupture.

During cryosurgery, a warming catheter inserted through the penis is intended to protect the urethra and preserve continence. However, because the overlying nerve bundles usually freeze, most men who have cryosurgery become sexually impotent. Moreover, while cryosurgery is less invasive than radical prostatectomy, doctors know much less about its long-term effectiveness.

Radiation Therapy

Radiation therapy uses high-energy x-rays, either beamed from a machine or emitted by radioactive seeds implanted in the prostate, to kill cancer cells. When prostate cancer is localized, radiation therapy can serve as an alternative to surgery. External beam radiation therapy is also commonly used to treat regional disease – cancers that have spread too widely in the pelvis to be removed surgically, but have not spread to the lymph nodes. In men with advanced disease, radiation therapy can also help shrink tumors and relieve pain.

Nevertheless, radiation that kills cancerous cells can also damage or kill healthy cells, resulting in increased risk for urinary or sexual dysfunction. Depending on the type of radiation used, up to one-half of patients may become impotent within two years of having radiation therapy. In addition, about 15% to 30% of men who have radiation therapy have urinary burning, urinary bleeding, frequent urination, rectal bleeding, rectal discomfort or diarrhea during or shortly after the treatment.

External Beam Radiation Therapy

External beam radiation therapy generally requires treatment five days a week for six or seven weeks. The treatment causes no pain, and each session lasts just a few minutes. The primary target is the prostate gland itself. If the tumor is large, hormonal therapy may be started at the time of radiation therapy in many cases, and continued for several years. In addition, the seminal vesicles may be irradiated, since prostate cancer commonly spreads to this location.

Brachytherapy

Radiation can also be delivered to the prostate from dozens of tiny radioactive seeds that are implanted directly into the prostate gland. This approach, known as interstitial implantation or brachytherapy, has the advantage of delivering a high dose of radiation to tissues in the immediate area, while minimizing damage to healthy tissues such as the rectum and bladder.

As practiced today, internal radiation therapy relies on ultrasound or CT to guide the placement of thin-walled needles through the skin of the perineum. Seeds made of radioactive palladium or iodine are delivered through the needles into the prostate, according to customized patterns developed using sophisticated computer programs – to conform to the shape and size of the individual's prostate.

Conformal Radiation Therapy

Three-dimensional conformal radiation therapy (3D-CRT) uses sophisticated computer software to precisely shape the distribution of radiation beams to the shape of the diseased prostate, thereby minimizing damage to normal tissue in the vicinity of treatment.

Using high-quality imaging techniques such as computed tomography (CT) or magnetic resonance imaging (MRI), plus powerful workstation computers, doctors are now able to visualize radiation therapy targets and aim radiation more directly at the tumor and cancerous tissues – while sparing critical adjacent normal structures.

Chemotherapy

Chemotherapy, which kills fast-growing cells, has not proven particularly effective against slow-growing prostate cancer cells. Several promising anticancer drugs are either under investigation, or are being used in conjunction with surgery or radiation therapy for men with advanced prostate cancer. Chemotherapy is also being tried along with hormonal therapy in men whose advanced cancers are no longer responsive to hormonal therapy alone. Chemotherapy is not recommended as a treatment if a man has early-stage prostate cancer.

Hormonal Therapy

Hormonal therapy combats prostate cancer by cutting off the supply of male hormones such as testosterone that encourage prostate cancer growth. Hormonal control can be achieved with surgical or medical castration, which involves removing the testicles or controlling their production of male hormones through prescription drugs.

Hormonal therapy can be used to target cancer that has spread beyond the prostate gland and is thus beyond the reach of local treatments such as surgery or radiation therapy. This treatment is also helpful in alleviating the painful and distressing symptoms of advanced disease. Furthermore, it is being investigated as a way to arrest cancer before it has a chance to metastasize. Although hormonal therapy cannot cure prostate cancer, it will usually shrink or halt the advance of the disease – often for years.

Hormonal control – whether through surgical castration or medical castration (hormonal drug therapy) – causes tumors and lymph nodes to shrink and PSA levels to fall. However, both castration methods can cause complications including hot flashes, impotence and a loss of interest in sex. Medical castration by treatment with hormonal drug therapy can cause breast enlargement and can increase a man's risk of cardiovascular problems, including heart attacks and strokes.

Observation – "Watchful Waiting"

Watchful waiting is based on the premise that localized prostate cancers may advance so slowly that they are unlikely to cause any problems during the patient's lifetime. Patients who opt for watchful waiting are typically asked to schedule regular medical checkups and to report any new symptoms immediately.

The most obvious candidates for watchful waiting are older men whose tumors are small and slow-growing, as judged by a low Gleason score and other diagnostic tests.

Many men who choose watchful waiting live for years with no signs of disease. A number of studies have found that, for at least 10 or even 15 years, the life expectancy of men treated with watchful waiting is not substantially different from the life expectancy of men treated with surgery or radiation – or, for that matter, of the population at large.

While clinical studies support the use of the da Vinci® System as an effective tool for minimally invasive surgery, individual results may vary. Always ask your doctor about the risks and benefits of all available treatment options.

For more information, please contact:
Intuitive Surgical
950 Kifer Road, Sunnyvale, CA 94086 USA
Tel: 408.523.2100 Fax: 408.523.1390
www.intuitivesurgical.com
www.davinciprostatectomy.com