



Testicular Cancer

What is cancer?

The body is made up of trillions of living cells. Normal body cells grow, divide, and die in an orderly fashion. During the early years of a person's life, normal cells divide faster to allow the person to grow. After the person becomes an adult, most cells divide only to replace worn-out or dying cells or to repair injuries.

Cancer begins when cells in a part of the body start to grow out of control. There are many kinds of cancer, but they all start because of out-of-control growth of abnormal cells.

Cancer cell growth is different from normal cell growth. Instead of dying, cancer cells continue to grow and form new, abnormal cells. Cancer cells can also invade (grow into) other tissues, something that normal cells cannot do. Growing out of control and invading other tissues are what makes a cell a cancer cell.

Cells become cancer cells because of damage to DNA. DNA is in every cell and directs all its actions. In a normal cell, when DNA gets damaged the cell either repairs the damage or the cell dies. In cancer cells, the damaged DNA is not repaired, but the cell doesn't die like it should. Instead, this cell goes on making new cells that the body does not need. These new cells will all have the same damaged DNA as the first cell does.

People can inherit damaged DNA, but most DNA damage is caused by mistakes that happen while the normal cell is reproducing or by something in our environment. Sometimes the cause of the DNA damage is something obvious, like cigarette smoking. But often no clear cause is found.

In most cases the cancer cells form a tumor. Some cancers, like leukemia, rarely form tumors. Instead, these cancer cells involve the blood and blood-forming organs and circulate through other tissues where they grow.

Cancer cells often travel to other parts of the body, where they begin to grow and form new tumors that replace normal tissue. This process is called metastasis. It happens when the cancer cells get into the bloodstream or lymph vessels of our body.

No matter where a cancer may spread, it is always named for the place where it started. For example, breast cancer that has spread to the liver is still called breast cancer, not liver cancer. Likewise, prostate cancer that has spread to the bone is metastatic prostate cancer, not bone cancer.

Different types of cancer can behave very differently. For example, lung cancer and breast cancer are very different diseases. They grow at different rates and respond to different treatments. That is why people with cancer need treatment that is aimed at their particular kind of cancer.

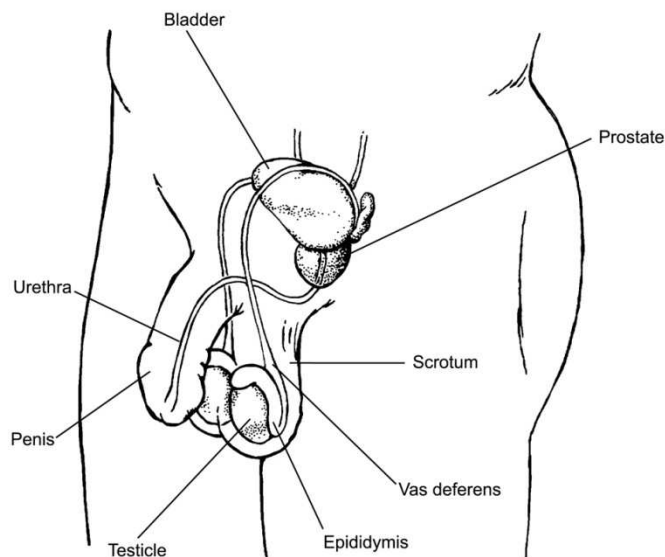
Not all tumors are cancerous. Tumors that aren't cancer are called benign. Benign tumors can cause problems -- they can grow very large and press on healthy organs and tissues. But they cannot grow into (invade) other tissues. Because they can't invade, they also can't spread to other parts of the body (metastasize). These tumors are almost never life threatening.

What is testicular cancer?

Testicular cancer typically develops in one or both testicles in young men. It is a highly treatable and usually curable type of cancer.

The testicles (also called the *testes*; a single testicle is called a *testis*) are part of the male reproductive system. These 2 organs are each normally somewhat smaller than a golf ball in adult males and are contained within a sac of skin called the scrotum. The scrotum hangs beneath the base of the penis.

The testicles make the male hormone testosterone. They also produce sperm. Sperm cells are carried from the testicle through the vas deferens to the seminal vesicles, where they are mixed with a fluid produced by the prostate gland. During ejaculation, sperm cells, seminal vesicle fluid, and prostatic fluid enter the urethra, the tube in the center of the penis through which both urine and semen leave the body.



The testicles are made up of several types of cells, and each may develop into one or more types of cancer. It is important to distinguish these types of cancers from one another because they differ in the ways they are treated and in their prognosis (outlook).

Germ cell tumors

More than 90% of cancers of the testicle develop in special cells known as germ cells. These are the cells that produce sperm. There are 2 main types of germ cell tumors (GCTs) in men: *seminomas* and *non-seminomas*. These 2 types occur about equally. Seminoma and non-seminoma cells look very different when seen under a microscope.

Some cancers contain both non-seminoma and seminoma cells. These are treated as non-seminomas because they grow and spread like non-seminomas.

Seminomas

Seminomas develop from the sperm-producing germ cells of the testicle. The 2 main subtypes of these tumors are classical (or typical) seminomas and spermatocytic seminomas. Doctors can tell them apart by how they look under the microscope.

Classical seminoma: More than 95% of seminomas are typical. These usually occur in men when they are between 25 and 45.

Spermatocytic seminoma: This rare type of seminoma tends to occur in older men. The average age of men diagnosed with spermatocytic seminoma is about 65. Spermatocytic tumors tend to grow more slowly and are less likely to spread to other parts of the body than classical seminomas.

Some seminomas can increase blood levels of a protein called human chorionic gonadotropin (HCG). HCG can be detected by a simple blood test and is considered a tumor marker for certain types of testicular cancer. It can be used for diagnosis and to check for response to therapy.

Non-seminomas

This type of germ cell tumor usually occurs in men between their late teens and early 30s. There are 4 main types of non-seminoma tumors:

- Embryonal carcinoma
- Yolk sac carcinoma
- Choriocarcinoma
- Teratoma

Most tumors are mixed with at least 2 different types, but this does not change treatment. All non-seminoma germ cell cancers are treated the same way.

Embryonal carcinomas: This type of non-seminoma is present to some degree in about 40% of testicular tumors, but pure embryonal carcinomas occur only 3% to 4% of the time. When seen under a microscope, these tumors can look like tissues of very early embryos. This type of non-seminoma tends to grow rapidly and spread outside the testicle. Embryonal carcinoma can increase blood levels of a tumor marker protein called alpha-fetoprotein (AFP), as well as HCG.

Yolk sac carcinomas: These are so named because their cells look like the yolk sac of an early human embryo. Other names for this cancer include yolk sac tumor, endodermal sinus tumor, infantile embryonal carcinoma, or orchidoblastoma.

Yolk sac carcinoma is the most common form of testicular cancer in children. When they occur in children, these tumors usually are treated successfully. But when yolk sac tumors develop in adults, they are of more concern, especially if they are "pure" (that is, the tumor does not contain other types of non-seminoma cells). Yolk sac carcinomas respond very well to chemotherapy, even if they have spread. This type of tumor almost always increases blood levels of AFP.

Choriocarcinomas: This is a very rare and aggressive type of testicular cancer that occurs in adults. These cancers are likely to spread rapidly to distant organs of the body, including the lungs, bone, and brain. Pure choriocarcinoma does not often occur in the testicles. More often, choriocarcinoma cells are present with other types of non-seminoma cells in a mixed germ cell tumor. This type of tumor increases blood levels of HCG.

Teratomas: Teratomas are germ cell tumors with areas that, when seen under the microscope, look like each of the 3 layers of a developing embryo: the endoderm (innermost layer), mesoderm (middle layer), and ectoderm (outer layer). The 3 main types of these tumors are the mature teratoma, immature teratoma, and teratoma with malignant transformation. Pure teratomas do not increase AFP or HCG levels.

Mature teratomas are tumors formed by cells similar to cells of adult tissues. They are generally benign and rarely spread to nearby tissues and distant parts of the body. They can usually be cured with surgery.

Sometimes deposits of mature teratoma are found after chemotherapy to treat a non-seminomatous mixed germ cell tumor is finished. These may be the part of a tumor that was left behind after chemotherapy has killed the other components of the tumors. Some experts believe that chemotherapy can change other types of non-seminoma into teratoma.

Immature teratomas are less well-developed cancers with cells that look like those of an early embryo. Unlike mature teratomas, this type is more likely to grow into (invade) surrounding tissues and to spread (metastasize) outside the testicle. It can also sometimes recur (come back) years after treatment.

Teratoma with malignant transformation is a very rare cancer. These cancers have some areas that look like mature teratomas but have other areas where the cells have become a

type of cancer that develops outside of the testicle, in tissues such as muscles, glands of the lungs or intestines, or the brain.

Carcinoma in situ

Testicular germ cell cancers may begin as a non-invasive form of the disease called *carcinoma in situ* (CIS) or *intratubular germ cell neoplasia*. Carcinoma in situ may not always progress to invasive cancer. Researchers have estimated that it can take about 5 years for CIS to progress to the invasive form of germ cell cancer.

It is hard to find CIS before it develops into invasive cancer because it generally causes no symptoms and often does not form a lump that you or the doctor can feel. The only way to diagnose testicular carcinoma in situ is to have a biopsy (a procedure that removes a tissue sample and looks at it under a microscope). Some cases are found incidentally (by accident) in men who have a testicular biopsy for some other reason, such as infertility.

Experts don't agree about the best treatment for CIS. Since CIS doesn't always become an invasive cancer, many doctors in this country consider observation (watchful waiting) to be the best treatment option.

When a testicular tumor like CIS becomes invasive, its cells are no longer just in the seminiferous tubules (where sperm cells are formed) but have grown into other structures of the testicle. These cancer cells can then spread either to the lymph nodes (small, bean-shaped collections of white blood cells that fight infection) through lymphatic channels (fluid-filled vessels that connect the series of lymph nodes), or through the blood circulation to other parts of the body.

Stromal tumors

Tumors can also develop in the supportive and hormone-producing tissues, or stroma, of the testicles. These tumors are known as gonadal stromal tumors. They make up less than 5% of adult testicular tumors but up to 20% of childhood testicular tumors. The 2 main types are Leydig cell tumors and Sertoli cell tumors.

Leydig cell tumors

These generally benign tumors develop from the Leydig cells in the testicle that normally produce male sex hormones (androgens like testosterone). Leydig cell tumors can develop in both adults (75% of cases) and children (25% of cases). They often produce androgens but sometimes produce estrogens (female sex hormones).

Most Leydig cell tumors do not spread beyond the testicle and are cured with surgery. But sometimes these tumors do spread to other parts of the body. If they do metastasize, Leydig cell tumors have a poor prognosis because they usually do not respond well to chemotherapy or radiation therapy.

Sertoli cell tumors

These tumors develop from normal Sertoli cells, which support and nourish the sperm-producing germ cells. Like the Leydig cell tumors, they are usually benign. But if they spread, they usually don't respond to chemotherapy and radiation therapy.

Secondary testicular tumors

Secondary testicular tumors start in another organ and then spread to the testicle. Lymphoma is the most common secondary testicular cancer. Testicular lymphoma is more common than primary testicular tumors in men older than 50. Their prognosis depends on the type and stage of lymphoma. The usual treatment is surgical removal, followed by radiation and/or chemotherapy. In boys with acute leukemia, the leukemia cells can sometimes form a tumor in the testicle.

Cancers of the prostate, lung, skin (melanoma), kidney, and other organs also can spread to the testicles. The prognosis for these cancers is usually poor because these cancers generally spread widely to other organs as well. Treatment depends on the specific type of cancer.

What are the key statistics about testicular cancer?

The American Cancer Society's most recent estimates for the United States are for 2012:

- About 8,590 new cases of testicular cancer will be diagnosed.
- About 360 men will die of testicular cancer.

The rate of testicular cancer has been increasing in the United States and many other countries. The increase is mostly in seminomas. Experts have not been able to find reasons for this increase. Lately, the rate of increase has slowed.

Testicular cancer is not common; a man's lifetime chance of developing testicular cancer is about 1 in 270. Because treatment is so successful, the risk of dying from this cancer is very low: about 1 in 5,000.

What are the risk factors for testicular cancer?

A risk factor is anything that changes your chance of getting a disease such as cancer. Different cancers have different risk factors. For example, exposing skin to strong sunlight is a risk factor for skin cancer. Smoking is a risk factor for many cancers. But having a risk factor, or even several, does not mean that you will get the disease. Just as having no risk factors doesn't mean you won't get the disease.

Scientists have found few risk factors that make a man more likely to develop testicular cancer. Even if a man has one or more risk factors for this disease, it is impossible to know for sure how much that risk factor contributes to developing the cancer. Also, most men with testicular cancer do not have any of the known risk factors.

Undescended testicle

One of the main risk factors for testicular cancer is a condition called *cryptorchidism*, or undescended testicle(s). This means that one or both testicles fail to move into the scrotum before birth. Males with cryptorchidism are several times more likely to get testicular cancer than those with normally descended testicles.

Normally, the testicles develop inside the abdomen of the fetus and they go down (descend) into the scrotum before birth. In about 3% of boys, however, the testicles do not make it all the way down before the child is born. Sometimes the testicle remains in the abdomen. In other cases, the testicle starts to descend but remains stuck in the groin area.

Most of the time, undescended testicles continue moving down into the scrotum during the child's first year of life. If the testicle has not descended by the time a child is a year old, it probably won't go down on its own. Sometimes a surgical procedure known as *orchiopexy* is needed to bring the testicle down into the scrotum.

The risk of testicular cancer may be somewhat higher for men whose testicle stayed in the abdomen as opposed to one that has descended at least partway. Most cancers develop in the undescended testicle, but about 1 out of 4 cases occur in the normally descended testicle. Based on these observations, some doctors conclude that cryptorchidism doesn't actually cause testicular cancer but that there is something else that leads to both testicular cancer and abnormal positioning of one or both testicles.

Orchiopexy done when a child is younger may be more likely to reduce the risk of testicular cancer than surgery that is done when the child is older. But the best time to do this surgery is not clear. Experts in the United States recommend that orchiopexy be done soon after the child's first birthday for reasons (such as fertility) that are not related to cancer.

Family history

A family history of testicular cancer increases the risk. If a man has the disease, there is an increased risk that one or more of his brothers or sons will also develop it. But only about 3% of testicular cancer cases are actually found to occur in families. Most men with testicular cancer do not have a family history of the disease.

HIV infection

Some evidence has shown that men infected with the human immunodeficiency virus (HIV), particularly those with AIDS, are at increased risk. No other infections have been shown to increase testicular cancer risk.

Carcinoma in situ

This condition, described in the section called "What is testicular cancer?", does not produce a mass or cause any symptoms. It isn't clear how often carcinoma in situ (CIS) in the testicles progresses to cancer. In some cases, CIS is found in men who have a testicular biopsy to evaluate infertility or have a testicle removed because of cryptorchidism. Doctors in Europe are more likely than the doctors in this country to look for CIS. This may be why the figures for diagnosis and progression of CIS to cancer are lower in the United States than in parts of Europe. Since we don't know how often CIS becomes true (invasive) cancer, it isn't clear that treating CIS is a good idea. Some experts think that it may be better to wait and see if the disease gets worse or becomes a true cancer. This could allow many men with CIS to avoid the risks and side effects of treatment. Radiation or surgery (to remove the testicle) is used to treat CIS.

Cancer of the other testicle

A personal history of testicular cancer is another risk factor. About 3% or 4% of men who have been cured of cancer in one testicle will eventually develop cancer in the other testicle.

Age

About half of testicular cancers occur in men between the ages of 20 and 34. But this cancer can affect males of any age, including infants and elderly men.

Race and ethnicity

The risk of testicular cancer among white men is about 5 times that of black men and more than 3 times that of Asian-American and American Indian men. The risk for Hispanics/Latinos falls between that of Asians and non-Hispanic/Latino whites. The reason for these differences is not known. Worldwide, the risk of developing this disease is highest among men living in the United States and Europe and lowest among men living in Africa or Asia.

Body size

Some studies have found that the risk of testicular cancer is somewhat higher in tall men, but other studies have not.

Unproven or controversial risk factors

Prior trauma to the testicles and recurrent actions such as horseback riding do not appear to be related to the development of testicular cancer.

Most studies have not found that strenuous physical activity increases testicular cancer risk. Being physically active has been linked with a lower risk of several other forms of cancer as well as a lower risk of many other health problems.

Do we know what causes testicular cancer?

The exact cause of most cases of testicular cancer is not known. But scientists have found that the disease is linked with a number of other conditions, which are described in the section called "What are the risk factors for testicular cancer?" A great deal of research is being done to learn more about the causes.

During the past few years, researchers have learned a lot about certain changes in chromosomes and DNA that may cause normal testicular germ cells to develop into germ cell tumors. Chromosomes are long strands of DNA and protein that carry genetic information about inherited traits. Each sperm or egg cell has half as many chromosomes as other body cells. So when the sperm and egg combine, the resulting embryo has a normal number of chromosomes, half of which are from each parent. This is why we tend to look like our parents.

Meiosis is the process by which germ cells with 46 chromosomes develop into sperm or egg cells with 23 chromosomes. Testicular germ cell tumors may form when something abnormal happens during meiosis. Instead of forming normal sperm cells with 23 chromosomes, all 46 chromosomes remain. Usually, these chromosomes become unstable and progressively more abnormal in their shape and number (often between 69 and 82) as the cells continue to divide. Testicular cancer cells often have extra copies of a part of chromosome 12 (this is called isochromosome 12p). Scientists are studying DNA from this chromosome to learn more about exactly what goes wrong during meiosis and how this might be prevented or reversed.

Several other abnormal chromosomes and changes in the factors that regulate cell division and the cell cycle have been associated with testicular cancer, both in animals and in humans. All of these changes are being studied to find the true causes of testicular cancer.

Can testicular cancer be prevented?

Many men with testicular cancer have no known risk factors. And some of the known risk factors, such as undescended testicles, white race, and a family history of the disease, are unavoidable. For these reasons, it is not possible now to prevent most cases of this disease.

It is wise to correct cryptorchidism in male children, but experts disagree if this changes the child's risk for testicular cancer. It does seem that correcting cryptorchidism earlier in life is better than waiting until puberty for reasons like fertility and body image. Furthermore, someone who knows that he has a risk factor such as cryptorchidism may be motivated to be more watchful and to practice testicular self-exam to allow an earlier diagnosis (see the section called "Can testicular cancer be found early?").

Can testicular cancer be found early?

Most testicular cancers can be found at an early stage. In some men, early testicular cancers cause symptoms that lead them to seek medical attention. Most of the time a lump on the testicle is the first sign. Unfortunately, however, some testicular cancers may not cause symptoms until after they have reached an advanced stage.

Most doctors agree that examining a man's testicles should be part of a general physical exam. The American Cancer Society (ACS) recommends a testicular exam as part of a routine cancer-related checkup.

The ACS advises men to be aware of testicular cancer and to see a doctor right away if they find a lump in a testicle. Because regular testicular self-exams have not been studied enough to show they reduce the death rate from this cancer, the ACS does not have a recommendation on regular testicular self-exams for all men. However, some doctors recommend that all men do monthly testicular self-exams after puberty.

Each man has to decide for himself whether or not to examine his testicles monthly, so instructions for testicular exams are included in this section. If you have certain risk factors that increase your chance of developing testicular cancer (such as an undescended testicle, previous germ cell tumor in one testicle, or a family history), you should seriously consider monthly self-exams and talk about it with your doctor.

Testicular self-exam

The best time for you to examine your testicles is during or after a bath or shower, when the skin of the scrotum is relaxed.

- Hold the penis out of the way and examine each testicle separately.
- Hold the testicle between your thumbs and fingers with both hands and roll it gently between the fingers.
- Look and feel for any hard lumps or nodules (smooth rounded masses) or any change in the size, shape, or consistency of the testes.

You should be aware that each normal testis has an epididymis, which can feel like a small bump on the upper or middle outer side of the testis. Normal testicles also contain blood vessels, supporting tissues, and tubes that conduct sperm. Some men may confuse these with cancer at first. If you have any concerns, ask your doctor.

A testicle can get larger for many reasons other than cancer. Fluid can collect around the testicle to form a benign condition called a hydrocele. Other times, the veins in the testicle can dilate and cause enlargement and lumpiness around the testicle. This is called a varicocele. To be sure you have one of these conditions and not a tumor; you need to have a doctor examine you. The doctor may order an ultrasound exam (see the section, "How is testicular cancer diagnosed?"). This is an easy and painless way of finding a tumor.

If you choose to examine your testicles, you will become familiar with what is normal and what is different. Always report any changes to your doctor without delay.

How is testicular cancer diagnosed?

Signs and symptoms of testicular cancer

In most testicular cancer cases, men have a lump on a testicle or they may notice the testicle is swollen or larger. Sometimes the lump causes pain, but most of the time it is not painful. Men with testicular cancer may mention a feeling of heaviness or aching in the lower abdomen or scrotum.

In rare cases, men with germ cell cancer notice their breasts are sore or have grown. This symptom occurs because certain types of germ cell tumors secrete high levels of a hormone called human chorionic gonadotropin (HCG), which stimulates breast development. Blood tests can measure HCG levels. These tests are important in diagnosis, staging, and follow-up of some testicular cancers.

Like germ cell tumors, Leydig cell tumors and Sertoli cell tumors can also cause a lump in the testicle. Leydig cell tumors can produce androgens (male sex hormones) or estrogens (female sex hormones). These hormones may cause symptoms that provide clues to the correct diagnosis. Breast growth or loss of sexual desire is a symptom of estrogen-producing tumors. Androgen-producing tumors may not cause any specific symptoms in men, but in boys they can cause growth of facial and body hair at an abnormally early age.

Even when testicular cancer has spread to other organs, only about 1 man in 4 may have symptoms. Lower back pain can be a sign that the cancer has spread to the lymph nodes in the abdomen. If the cancer has spread to the lungs, the man may notice trouble breathing (shortness of breath), chest pain, or a cough. Sometimes the man may even cough up blood. Occasionally men will have abdominal pain, either from enlarged lymph nodes or metastasis (spread) to the liver. In rare cases, testicular cancer spreads to the brain and can cause headaches.

Some men with testicular cancer have no symptoms at all, and their cancer is found during medical testing for other conditions. Sometimes imaging tests done to find the cause of infertility can uncover a small testicular cancer.

A number of non-cancerous conditions, such as testicle injury or inflammation, can produce symptoms similar to those of testicular cancer. Inflammation of the testicle (known as *orchitis*) and inflammation of the epididymis (*epididymitis*) can cause swelling and pain of the testicle. Both of these can be caused by viral or bacterial infections. The mumps virus causes orchitis in about 1 man in 5 who contracts mumps as an adult.

If you have any of the signs or symptoms described above, see your doctor without delay. Many of these symptoms are more likely to be caused by something other than testicular cancer. But if a tumor is the cause, the sooner you get an accurate diagnosis, the sooner

you can start treatment and the more effective your treatment is likely to be. For more information, see our document called *Do I Have Testicular Cancer?*

Medical history and physical exam

If you have signs or symptoms that may suggest testicular cancer, your doctor will want to take a complete medical history to check for risk factors and symptoms. During a physical exam, the doctor will feel the testicles for swelling or tenderness and for the size and location of any lumps. The doctor will also examine your abdomen, lymph nodes, and other parts of your body carefully, looking for any signs the tumor has spread. Often the results of the exam are normal aside from the testicular abnormalities.

Ultrasound of the testicles

An ultrasound can help doctors tell if a lump is solid or filled with fluid. This test uses sound waves to produce images of internal organs. A transducer (wand-like instrument) emits the sound waves and picks up the echoes as they bounce off the organs. A computer processes the pattern of echoes to produce an image on a monitor. The echoes from most tumors differ from those of normal tissues. These patterns of echoes also can help distinguish some types of benign and malignant tumors from one another.

This is an easy test to have and it uses no radiation, which is why it is often used to look at developing fetuses. You simply lie on your back on a table and a technician moves the transducer along the skin of the scrotum. Usually, the skin is first lubricated with gel. The pattern of echoes reflected by tissues can be used to distinguish certain benign conditions (like hydrocele or varicocele), from a solid tumor that could be a cancer. If the lump is solid, then it may be a cancer and the doctor may recommend further tests or even surgery to remove the tumor.

Blood tests for tumor markers

Some blood tests can help diagnose testicular tumors. Many testicular cancers secrete high levels of certain proteins, such as alpha-fetoprotein (AFP) and human chorionic gonadotropin (HCG). When these proteins (called tumor markers) are in the blood, it suggests that there is a testicular tumor. A tumor may also increase the levels of an enzyme called lactate dehydrogenase (LDH). However, LDH levels can also be increased in conditions other than cancer.

Non-seminomas often raise AFP and/or HCG levels. Pure seminomas occasionally raise HCG levels but never AFP levels, so any increase in AFP means that the tumor has a non-seminoma component. (Tumors can be mixed and have areas of seminoma and non-seminoma.) A high LDH often (but not always) indicates widespread disease. Sertoli and Leydig cell tumors do not produce these substances. The levels of these proteins may not be elevated if the tumor is small.

These tests also sometimes help estimate how much cancer is present, to evaluate the response to therapy, and to make sure the tumor has not returned. For more information on tumor markers, see the section called "How is testicular cancer staged?"

Surgery to diagnose testicular cancer

If the doctor sees a solid tumor on ultrasound, he or she will recommend surgery to remove it as soon as possible. The surgeon will try to remove the entire tumor along with the testicle and spermatic cord. The spermatic cord contains blood and lymph vessels that may act as pathways for testicular cancer to spread to the rest of the body. To lessen the chance that cancer cells will spread, these vessels are tied off early in the operation. This is best done by operating through an incision (cut) in the groin. This operation is called a *radical inguinal orchiectomy*.

The entire specimen is sent to the lab, where a pathologist (a doctor specializing in laboratory diagnosis of diseases) examines the tissue under a microscope. If cancer cells are present, the pathologist sends back a report describing the type and extent of the cancer.

In rare cases, when a diagnosis of testicular cancer is uncertain, the doctor may biopsy the testicle before removing it. This is done in surgery. During this operation, the surgeon makes a cut in the groin, withdraws the testicle from the scrotum, and examines it without cutting the spermatic cord. If suspicious tissue is seen, a portion of the tissue is removed and immediately looked at by the pathologist. If cancer is found, the testicle and spermatic cord are removed. If the tissue is not cancerous, the testicle can often be returned to the scrotum, and treatment will be surgery to remove only the tumor or the use of appropriate medicines.

If the diagnosis of cancer is made, your doctor will order other imaging tests to see if it has spread outside of the testicle.

Imaging tests

Chest x-ray

This is a plain x-ray of your chest and can be taken in any outpatient setting. This test is done to see if your cancer has spread to your lungs or the lymph nodes in the middle area of the chest known as the *mediastinum*. If the x-ray result is normal, you probably don't have cancer in your lungs. But most doctors feel a computed tomography (CT) scan can better judge whether the cancer has spread to the chest.

Computed tomography scan

The computed tomography (CT) scan is an x-ray procedure that produces detailed cross-sectional images of your body. Instead of taking one picture, like a conventional x-ray, a CT scanner takes many pictures of the part of your body being studied as it rotates around you. A computer then combines these pictures into an image of a slice of your body.

CT scans are helpful in staging the cancer. They can help tell if your cancer has spread into your lymph nodes, lungs, liver, or other organs.

Before the scan, you may be asked to drink a contrast solution and/or get an intravenous (IV) injection of a contrast dye that helps better outline abnormal areas in the body. You may need an IV line to inject the contrast dye.

The injection can cause some flushing (redness and warm feeling that may last hours to days). A few people are allergic to the dye and get hives. Rarely, more serious reactions like trouble breathing and low blood pressure can occur. Medicine can be given to prevent and treat allergic reactions. Be sure to tell the doctor if you have ever reacted to any contrast material used for x-rays or if you have an allergy to shellfish.

You need to lie still on a table while the scan is being done. During the test, the table moves in and out of the scanner, a ring-shaped machine that completely surrounds the table. You might feel a bit confined by the ring you have to lie in while the pictures are being taken.

CT scans are sometimes used to guide a biopsy needle precisely into a suspected metastasis. For this procedure, called a *CT-guided needle biopsy*, you remain on the CT scanning table while a radiologist advances a biopsy needle through the skin toward the location of the mass. CT scans are repeated until the doctors are confident that the needle is within the mass. A fine needle biopsy sample (tiny fragment of tissue) or a core needle biopsy sample (a thin cylinder of tissue) is removed and examined under a microscope.

Magnetic resonance imaging scan

Like CT scans, magnetic resonance imaging (MRI) scans provide detailed images of soft tissues in the body. But MRI scans use radio waves and strong magnets instead of x-rays. The energy from the radio waves is absorbed and then released in a pattern formed by the type of tissue and by certain diseases. A computer translates the pattern of radio waves given off by the tissues into a very detailed image of parts of the body. A contrast material might be injected just as with CT scans but is used less often.

MRI scans are particularly helpful in examining the brain and spinal cord.

MRI scans are a little more uncomfortable than CT scans. First, they take longer -- often up to an hour. You may be placed inside a large cylindrical tube, which is confining and can upset people with a fear of enclosed spaces. Special, more open MRI machines can help with this if needed. The MRI machine makes buzzing and clicking noises that you may find disturbing. Some places will provide earplugs to help block this out.

Positron emission tomography scan

For a positron emission tomography (PET) scan, radioactive glucose (sugar) is injected into the patient's vein. The amount of radioactivity is very low. Cancers use sugar much faster than normal tissues so the cancer cells in the body absorb large amounts of the radioactive substance. A special camera can then be used to create a picture of areas of

radioactivity in the body. The picture is not finely detailed like a CT or MRI scan, but it can provide helpful information about your whole body.

This test can be helpful for spotting small collections of cancer cells. It is sometimes useful for looking at enlarged lymph nodes that remain after chemotherapy. A PET scan may help the doctor decide if they contain scar tissue or active tumor. Often the PET scan is combined with a CT scan. This helps decide if abnormalities seen on the CT scan are cancer or something else.

PET scans are often more useful for seminoma than for the non-seminoma type of testicular cancer, and so are less often used in patients with non-seminoma.

How is testicular cancer staged?

Staging is the process of finding out how far the cancer has spread. In addition to tests used to diagnose testicular cancer, imaging tests and blood tests are also used to determine the stage.

The stage of your cancer is very important for planning your treatment and estimating your prognosis (outlook). If you have testicular cancer, ask your cancer care team to explain staging in a way that you can understand. Knowing all you can about staging lets you take a more active role in making decisions about your treatment.

The TNM staging system

A staging system is a standardized way for your cancer care team to summarize and describe the extent of your cancer. Testicular cancer is staged using the TNM system created by the American Joint Committee on Cancer (AJCC).

The staging system of testicular cancer contains 4 key pieces of information:

- **T** refers to how much the primary tumor has spread to tissues next to the testicle.
- **N** describes how much the cancer has spread to regional (nearby) lymph nodes.
- **M** indicates whether the cancer has metastasized (spread to distant lymph nodes or other organs of the body).
- **S** indicates the serum levels of certain proteins (tumor markers) that are produced by some testicular cancers.

Additional letters or numbers appear after T, N, M, and S to provide more details about each piece of information. The numbers 0 through 4 indicate increasing severity. The letters "is" after the T stand for in situ, which means the tumor is contained in one place and has not yet penetrated to a deeper layer of tissue. The letter X after T, N, M, or S means "cannot be assessed" because the information is not known.

Primary tumor (T)

TX: The primary tumor cannot be assessed

T0: There is no evidence of primary tumor

Tis: Carcinoma in situ (noninvasive cancer cells)

T1: The tumor has not spread beyond the testicle and the narrow tubules next to the testicles where sperm undergo final maturation (epididymis). Cancer cells are not found inside blood vessels or lymph vessels next to the tumor. The cancer may have grown through the inner layer surrounding the testicle (tunica albuginea) but not the outer layer covering the testicle (tunica vaginalis).

T2: Similar to T1 except that the cancer has spread to blood or lymph vessels near the tumor, or the tunica vaginalis

T3: The tumor is growing into the spermatic cord (which contains blood vessels, lymph vessels, nerves, and the vas deferens)

T4: The tumor is growing into the skin surrounding the testicles (scrotum)

Regional lymph nodes (N)

NX: Regional (nearby) lymph nodes cannot be assessed

N0: No spread to regional lymph nodes is seen on x-rays

N1: There is spread to at least one lymph node, but no lymph node is larger than 2 cm (about 3/4 inch) in any dimension

N2: There is spread to at least one lymph node that is larger than 2 cm but is not bigger than 5 cm (2 inches) in any dimension

N3: There is spread at least one lymph node that is larger than 5 cm in any dimension

If the lymph nodes were taken out during surgery, there is a slightly different classification:

pNX: Regional (nearby) lymph nodes cannot be assessed

pN0: There is no spread to regional lymph nodes

pN1: There is spread to 1 to 5 lymph nodes, with no lymph node larger than 2 cm (about 3/4 inch) across in greatest dimension

pN2: There is spread to at least one lymph node that is bigger than 2 cm but not larger than 5 cm; OR spread to more than 5 lymph nodes that aren't bigger than 5 cm; OR the cancer is growing out the side of the lymph node

pN3: There is spread to at least one lymph node that is bigger than 5 cm

Distant metastasis (M)

M0: There is no distant metastasis (no spread to lymph nodes outside the area of the tumor or other organs, such as the lungs)

M1: Distant metastasis is present

- **M1a:** The tumor has metastasized to distant lymph nodes or to the lung
- **M1b:** The tumor has metastasized to other organs, such as the liver, brain, or bone

Serum tumor markers (S)

| | LDH (U/liter) | HCG (mIU/ml) | AFP (ng/ml) |
|------------|--|---------------------|--------------------|
| SX | Marker studies not available or not performed. | | |
| S0 | Normal | Normal | Normal |
| S1* | <1.5 x Normal | <5,000 | <1,000 |
| S2+ | 1.5 - 10 x Normal | 5,000 - 50,000 | 1,000 - 10,000 |
| S3+ | >10 x Normal | >50,000 | >10,000 |

Note: Normal values vary between laboratories. Check with your doctor for your specific ranges.

LDH = lactate dehydrogenase (measured in Units per liter [U/liter])

HCG = human chorionic gonadotropin (measured in milli-International Units per milliliter [mIU/ml])

AFP = alpha-fetoprotein (measured in nanograms per milliliter [ng/ml])

< Means less than; > means more than.

**All the markers must be in the stated range to be considered S1*

+Only one marker needs to be in the stated range to be considered S2 or S3

Stage grouping

Using the TNM staging system, the descriptions of the tumor, lymph nodes, metastasis, and serum markers are combined in a process called stage grouping to assign a stage using Roman numerals.

| Stage | T | N | M | S |
|--------------|---------------|----------|----------|----------|
| Stage 0 | Tis (in situ) | N0 | M0 | S0 |
| Stage I | T1-T4 | N0 | M0 | SX |
| Stage IA | T1 | N0 | M0 | S0 |
| Stage IB | T2-T4 | N0 | M0 | S0 |
| Stage IS | Any T | N0 | M0 | S1-S3* |
| Stage II | Any T | N1-N3 | M0 | SX |
| Stage IIA | Any T | N1 | M0 | S0-S1 |
| Stage IIB | Any T | N2 | M0 | S0-S1 |
| Stage IIC | Any T | N3 | M0 | S0-S1 |
| Stage III | Any T | Any N | M1 | SX |
| Stage IIIA | Any T | Any N | M1a | S0-S1 |
| Stage IIIB | Any T | N1-N3 | M0 | S2 |
| | Any T | Any N | M1a | S2 |
| Stage IIIC | Any T | N1-N3 | M0 | S3 |
| | Any T | Any N | M1a | S3 |
| | Any T | Any N | M1b | Any S |

* For stage IS, tumor markers are measured after the testicle has been removed with surgery (for all other stages, the values obtained before surgery are used).

International Germ Cell Cancer Consensus Group Classification

Another application of the TNM system used for more advanced disease takes into account the tumor markers (measured after surgery) and where the cancer has spread. It classifies the cancer as good, intermediate, or poor prognosis (outlook). Some doctors give more aggressive chemotherapy regimens to patients who are in a higher-risk category.

| Risk Status | Non-seminoma | Stages | Seminoma | Stages |
|--------------------------|--|--|---|-----------------------------|
| Good prognosis (outlook) | No non-lung spread* AND All good markers: AFP < 1,000 HCG < 5,000 LDH < 1.5 x normal | IS (S1) Some IIA, B, C Some IIIA | No non-lung spread* AFP normal** HCG and LDH can be any level | IIC IIIA IIIB IIIC |
| Intermediate prognosis | No non-lung spread* AND Any intermediate markers: AFP 1,000 -10,000 HCG 5,000 - 50,000 LDH 1.5 – 10 x normal | IS (S2) Some IIIB | Non-lung spread* AFP normal** HCG and LDH can be any level | IIIC with non-lung spread* |
| Poor prognosis | Non-lung spread* OR Mediastinal primary + OR Any high markers: AFP >10,000 HCG > 50,000 LDH > 10 x normal | IS (S3) Some IIIC | None (seminoma is never classified as poor outlook) | |

*Spread to non-lung sites such as the brain or liver generally indicates a poorer prognosis (outlook).

AFP = alpha-fetoprotein; HCG = human chorionic gonadotropin; LDH = lactate dehydrogenase

< Means less than; > means greater than.

+Tumor found in the mediastinum, not the testicle, as the primary site.

***Seminoma should not cause the AFP level to rise, so if the AFP level is not normal, the tumor is not a pure seminoma and should be considered a non-seminoma*

Recurrent disease

Recurrent disease means that the cancer has come back (recurred) after treatment. Testicular cancer may recur in the testicle (if it was not removed during surgery) or in another part of the body.

Testicular cancer survival rates

Survival rates are often used by doctors as a standard way of discussing a person's prognosis (outlook). Some patients with cancer may want to know the survival statistics for people in similar situations, while others may not find the numbers helpful, or may even not want to know them. If you decide that you don't want to know them, stop reading here and skip to the next section.

The 5-year survival rate refers to the percentage of patients who live at least 5 years after their cancer is diagnosed. Of course, many people live much longer than 5 years (and many are cured).

Five-year relative survival rates assume that some people will die of other causes and compare the observed survival with that expected for people without the cancer. This is a better way to see the impact of the cancer on survival.

In order to get 5-year survival rates, doctors have to look at people who were treated at least 5 years ago. Improvements in treatment since then may result in a more favorable outlook for people now being diagnosed with testicular cancer.

Survival rates are often based on previous outcomes of large numbers of people who had the disease, but they cannot predict what will happen in any particular person's case. Many other factors may affect a person's outlook, such as your age and how well the cancer responds to treatment. Your doctor can tell you how the numbers below may apply to you, as he or she is familiar with the aspects of your particular situation.

The survival statistics below come from the National Cancer Institute's Surveillance, Epidemiology, and End Results (SEER) database, and are based on patients who were diagnosed with testicular cancer between 2001 and 2007. The SEER database does not divide survival rates by AJCC stage. Instead, this database divides cancers into the summary stages: localized, regional, and distant. Localized means that the cancer is only growing in the testicle. This includes most AJCC stage I tumors (stage 0 cancers are not included in these statistics). Regional means that the cancer has spread to nearby lymph nodes or tissues. This includes T4 tumors and cancers with lymph node spread (all stage II cancers and some stage IIIB and IIIC cancers). Distant means that the cancer has spread to organs or lymph nodes away from the tumor, such as all M1 cancers (which can be stage IIIA, IIIB, or IIIC).

| Stage | 5-Year Relative Survival Rate |
|--------------|--------------------------------------|
| Localized | 99% |
| Regional | 96% |
| Distant | 72% |

The 5-year relative survival rate for all men with this cancer is 95%. More than 200,000 men in the United States have survived testicular cancer.

For more advanced testicular cancer (stages besides IA and IB), statistics exist for survival by risk group. These look at overall survival, and so don't take into account deaths from other causes.

| Risk Group | 5-Year Survival Rate |
|------------------------|-----------------------------|
| Good Prognosis | 91% |
| Intermediate Prognosis | 79% |
| Poor Prognosis | 48% |

These survival rates are taken from a study of patients treated more than 25 years ago. Survival is likely to be better today.

How is testicular cancer treated?

This information represents the views of the doctors and nurses serving on the American Cancer Society's Cancer Information Database Editorial Board. These views are based on their interpretation of studies published in medical journals, as well as their own professional experience.

The treatment information in this document is not official policy of the Society and is not intended as medical advice to replace the expertise and judgment of your cancer care team. It is intended to help you and your family make informed decisions, together with your doctor.

Your doctor may have reasons for suggesting a treatment plan different from these general treatment options. Don't hesitate to ask him or her questions about your treatment options.

Making treatment decisions

In recent years, much progress has been made in treating testicular cancer. Surgical methods have been refined, and doctors know more about the best ways to use chemotherapy and radiation to treat different types of testicular cancer.

After the cancer is diagnosed and staged, your cancer care team will discuss treatment options with you. You should take time and think about all of the choices. The type and stage of the cancer, as well as your overall physical health are factors to consider when choosing your treatment plan. When time permits, getting a second opinion is often a good idea. It can give you more information and help you feel good about the chosen treatment plan. Some insurance companies may require a second opinion before they will agree to pay for treatments.

Where you are treated is important. There is no substitute for experience. You have the best chance for a good outcome if you go to a hospital that treats many testicular cancer patients.

The 3 main methods of treatment for testicular cancer are:

- Surgery
- Radiation therapy
- Chemotherapy (chemo)

The first part of this section describes the various types of treatments used for testicular cancers. This is followed by a description of the most common approaches used based on the type and extent of the disease.

Surgery for testicular cancer

Surgery is typically the first treatment for all testicular cancers.

Radical inguinal orchiectomy

As described in the section called "How is testicular cancer diagnosed?", this type of surgery removes the testicle (or testicles) containing the cancer. An incision is made in the groin, and the testicle is taken from the scrotum through the opening. A cut is made through the spermatic cord that attaches the testicle to the abdomen. The surgeon takes special precautions to avoid spreading cancer cells into the surgical wound or dislodging them from the tumor into the bloodstream. All stages of testicular cancer are typically treated with this type surgery.

Retroperitoneal lymph node dissection

Depending on the type and stage of your cancer, some lymph nodes behind the abdomen may also be removed at the same time or during a second operation. (In some patients, after the affected testicle is removed, surgery will not be done on the retroperitoneal

lymph nodes, but the patient is carefully watched with frequent clinical exams and CT scans.)

Retroperitoneal lymph node dissection can be a major operation. A large incision is often made to remove these lymph nodes. About 5% to 10% of patients have temporary complications after surgery, such as bowel obstruction or wound infections. This is a difficult and long operation. It should be done by a surgeon who does them often. Experience counts.

Laparoscopic surgery: In some cases, the surgeon can remove lymph nodes through very small skin incisions in the abdomen by using a laparoscope (a narrow, lighted tube, which lets doctors operate on the abdomen without making a large incision and scar). Laparoscopic surgery seems to be a lot easier for the patient, but doctors are unsure if it is as safe and efficient as the open surgery in removing all of the potentially cancerous lymph nodes. That is why if the lymph nodes removed contain cancer, the patient is often treated with chemotherapy, as well.

In laparoscopic surgery, after being put to sleep, the patient is turned onto his side. Small keyhole-like incisions are made on the abdomen. The surgeon's hands are not inside the patient's body during surgery. A video camera and long instruments are inserted through these incisions. The surgeon sees the inside of the abdomen on a television monitor. Using these long instruments, the lymph nodes around the aorta and inferior vena cava (large blood vessels) can be removed through one of the incisions. The small incisions are closed and the patient is awakened. Patients recover much more quickly from this operation than the standard open procedure and are walking soon after surgery. The hospital stay ranges from 2 to 4 days. There is usually less pain and patients are eating sooner. This procedure is most often used for patients with early stage non-seminomas to see if the lymph nodes contain cancer. This procedure should only be done if the surgeon is very experienced.

Possible effects on sexual function and fertility

Surgery to remove retroperitoneal lymph nodes may damage nearby nerves that control ejaculation. If these nerves are damaged, when a male ejaculates, the semen is not propelled forward through the urethra to exit the body but rather goes backwards into the bladder. This is known as *retrograde ejaculation*. This type of surgery does not cause impotence -- a man can still have erections and sexual intercourse -- but retrograde ejaculation can make it harder to father children. To save the normal ejaculation function, surgeons have developed a type of retroperitoneal lymph node surgery called *nerve-sparing* surgery that has a very high rate of success in experienced hands.

If both testicles are removed, sperm cells cannot be produced and a man becomes infertile. Also, without testicles, a man cannot make enough testosterone. He will need to take supplements, either in the form of a gel, a patch, or a shot. Pills are generally not reliable sources of testosterone.

Testicular cancer often affects men at an age when they may be trying to have children. These men may wish to discuss nerve-sparing surgery with their doctors, as well as

sperm banking (freezing and storing sperm cells obtained before treatment). Men with testicular cancer often have lower than normal sperm counts, which may make it difficult to collect a good sperm sample.

Men with testicular cancer are usually young and may be concerned that their appearance has changed. They may be single and dating and worry about a partner's reaction, or they may be athletic and feel embarrassed by the missing testicle when in locker rooms. Since the operation also removes the cord above the testicle, that side of the scrotum can look and feel empty to them.

To restore a more natural look, a man can have a testicular prosthesis surgically implanted in his scrotum. The prosthesis approved for use in the United States is filled with saline (salt water), and it comes in different sizes to match the remaining testicle. When in place, it can look like a normal testicle. There can be a scar after the operation, but it is often partly hidden by pubic hair. Some men want to have a prosthesis and others do not. You should discuss your wishes with your surgeon before considering this surgery. It may also help to talk with someone who has a testicular prosthesis, to see what their experience has been like.

Losing a testicle usually has no effect on a man's ability to get an erection and have sex. Men who have had both testicles removed are also still able to have sex as long as they are getting enough testosterone.

Radiation therapy for testicular cancer

Radiation therapy uses a beam of high-energy rays (such as gamma rays or x-rays) or particles (such as electrons, protons, or neutrons) to destroy cancer cells or slow their rate of growth. In treating testicular cancer, radiation is used mainly to kill cancer cells that have spread to lymph nodes.

Radiation therapy for testicular cancer is delivered by a carefully focused beam of radiation from a machine outside the body. This is known as external beam radiation. The treatment is much like getting an x-ray, but the radiation is more intense. The procedure itself is painless. Before your treatments start, the medical team will take careful measurements to determine the correct angles for aiming the radiation beams and the proper dose of radiation. Each treatment lasts only a few minutes, but the setup time -- getting you into place for treatment -- usually takes longer.

In general, radiotherapy is mainly used for patients with seminoma, which is very sensitive to radiation. It does not seem to work well for non-seminomas. Sometimes it is used after orchiectomy (the operation to remove the testicle) and is directed at the lymph nodes at the back of the abdomen (the retroperitoneal lymph nodes). This is to kill any tiny bits of cancer in those lymph nodes that can't be seen. Radiotherapy can also be used to treat small amounts of seminoma that are known to have spread to the nodes (based on changes seen on CT and PET scans).

Possible side effects

Radiation therapy can affect nearby healthy tissue along with the cancer cells. To reduce the risk of side effects, doctors carefully figure out the exact dose you need and aim the beam as accurately as they can to hit the target. Generally, treatment of testicular cancer uses lower radiation doses than those needed for other types of cancer.

Common side effects include fatigue, nausea, or diarrhea. Some men experience a skin reaction that is like a sunburn, but it's uncommon. This slowly fades away. Radiation to the healthy testicle can affect fertility (sperm counts), so a special protective device is placed over the remaining testicle to help protect it. Radiation can also increase the risk of getting a second cancer (outside of the testicle). This risk was higher in the past when higher doses were used and more tissue was exposed to radiation.

Chemotherapy for testicular cancer

Chemotherapy (chemo) is the use of drugs for treating cancer. The drugs can be swallowed in pill form, or they can be injected by needle into a vein or muscle. To treat testicular cancer, the drugs are usually given into a vein. Chemo is considered systemic therapy. This means that the drug enters the bloodstream and circulates throughout the body to reach and destroy the cancer cells. Chemo is an effective way to destroy any cancer cells that break off from the main tumor and travel in the bloodstream to lymph nodes or distant organs.

Chemo is often used to cure testicular cancer when it has spread outside the testicle or to decrease the risk of cancer coming back after the testicle is removed. It is not used to treat the cancer that is only in the testicle.

Doctors give chemotherapy in cycles, with each period of treatment followed by a rest period to allow the body time to recover. Chemo cycles generally last about 3 to 4 weeks. Using 2 or more chemotherapy drugs is often more effective than using any single drug. The main drugs used to treat testicular cancer are:

- Cisplatin
- Vinblastine
- Bleomycin
- Cyclophosphamide (Cytosan[®])
- Etoposide (VP-16)
- Paclitaxel (Taxol[®])
- Ifosfamide (Ifex[®])

These drugs are used in various combinations. The chemotherapy regimens most commonly used as the initial treatment for testicular cancer are bleomycin, etoposide, and cisplatin (called BEP or PEB), or etoposide and cisplatin (also known as EP). Another

combination that may be used is called VIP and includes the drugs VP-16 (etoposide) or vinblastine plus ifosfamide and cisplatin. Some doctors believe that a more intensive regimen should be used for patients with high-risk disease, and may suggest a different combination of chemotherapy drugs or even a stem cell transplant (see next section).

Possible side effects

Chemo drugs work by attacking cells that are dividing quickly, which is why they work against cancer cells. But other cells in the body, such as those in the bone marrow, the lining of the mouth and intestines, and the hair follicles, also divide quickly. These cells are also likely to be affected by chemo, which can lead to certain side effects.

The side effects of chemo depend on the type and dose of drugs used and how long they are given. These side effects can include:

- Hair loss
- Mouth sores
- Loss of appetite
- Nausea and vomiting
- Increased chance of infections (due to low white blood cell counts)
- Easy bruising or bleeding (due to low blood platelet counts)
- Fatigue (due to low red blood cell counts)

Some of the drugs used to treat testicular cancer can have other side effects. For example, cisplatin can cause kidney damage. This can be lessened by giving lots of fluids (usually into a vein – IV) before and after the drug is given. Cisplatin, etoposide, paclitaxel, and vinblastine can damage nerves (known as *neuropathy*). This can lead to hearing loss, numbness or tingling sensations in the hands or feet, and sensitivity to cold or heat. In most cases this goes away once treatment is stopped, but it may last a long time in some people. Bleomycin can damage lungs, causing shortness of breath and trouble with physical activity. Ifosfamide can cause the bladder to bleed (called *hemorrhagic cystitis*). To prevent this, a drug called mesna is given along with ifosfamide.

Most side effects are short-term and go away after treatment is finished, but some can last a long time and may never go away completely. You should report any side effects or changes you notice while getting chemotherapy to your medical team so that you can get prompt treatment for them. There are often ways to prevent or lessen side effects. For example, there are drugs that can be given to help prevent or reduce nausea and vomiting. In some cases, the doses of the chemotherapy drugs may need to be reduced or treatment may need to be delayed or stopped to prevent the effects from getting worse.

Some of the drugs used to treat testicular cancer can cause long term side effects. These include some of the things mentioned earlier, like hearing loss and kidney damage, Development of a second cancer (like leukemia) is a very serious but fortunately, a rare

side effect of chemo. It occurs in less than 1% of testicular cancer patients treated with chemo. People who have had chemo for testicular cancer seem to have a higher risk of heart problems later in life. Several studies have also suggested that this chemotherapy treatment can sometimes cause high blood cholesterol to develop over time, which may later require treatment.

For more information about chemotherapy and its side effects, please our document called *Understanding Chemotherapy: A Guide for Patients and Families*.

High-dose chemotherapy and stem cell transplant for testicular cancer

In general, testicular cancers respond well to chemotherapy (chemo), but not all cancers are cured. Even though higher doses of chemo might be more effective, they are not given because they could severely damage the bone marrow, which is where new blood cells are formed. This could lead to life-threatening infections, bleeding, and other problems because of low blood cell counts.

A stem cell transplant allows doctors to use higher doses of chemo. Blood-forming stem cells are collected from the bloodstream in the weeks before treatment using a special machine. In the past the stem cells were taken from the bone marrow, but this is done less often now. These stem cells are frozen, and then the patient receives high-doses of chemo. After the chemo the patient gets his stem cells back again. This is called a transplant, but it does not involve surgery – the cells are infused into a vein much like a blood transfusion. The stem cells settle in the bone marrow and start making new blood cells over the next few weeks.

For testicular cancer, stem cell transplant is most often used to treat cancers that have come back after treatment with chemo. Current studies are exploring whether high-dose chemo followed by a stem cell transplant may be valuable in treating some patients with advanced germ cell cancers as part of their first treatment.

This is a complex and intense treatment. It should be done at a hospital where the staff has experience with the procedure and with managing the recovery phase. Stem cell transplants can be very expensive and often require a lengthy hospital stay. It is important to find out what your insurer will cover before deciding on a transplant to get an idea of what you might have to pay.

For more information on stem cell transplants see our document called *Bone Marrow and Peripheral Blood Stem Cell Transplants*.

Clinical trials for testicular cancer

You may have had to make a lot of decisions since you've been told you have cancer. One of the most important decisions you will make is choosing which treatment is best for you. You may have heard about clinical trials being done for your type of cancer. Or maybe someone on your health care team has mentioned a clinical trial to you.

Clinical trials are carefully controlled research studies that are done with patients who volunteer for them. They are done to get a closer look at promising new treatments or procedures.

If you would like to take part in a clinical trial, you should start by asking your doctor if your clinic or hospital conducts clinical trials. You can also call our clinical trials matching service for a list of clinical trials that meet your medical needs. You can reach this service at 1-800-303-5691 or on our Web site at www.cancer.org/clinicaltrials. You can also get a list of current clinical trials by calling the National Cancer Institute's Cancer Information Service toll-free at 1-800-4-CANCER (1-800-422-6237) or by visiting the NCI clinical trials Web site at www.cancer.gov/clinicaltrials.

There are requirements you must meet to take part in any clinical trial. If you do qualify for a clinical trial, it is up to you whether or not to enter (enroll in) it.

Clinical trials are one way to get state-of-the-art cancer treatment. They are the only way for doctors to learn better methods to treat cancer. Still, they are not right for everyone.

You can get a lot more information on clinical trials in our document called *Clinical Trials: What You Need to Know*. You can read it on our Web site or call our toll-free number (1-800-227-2345) and have it sent to you.

Complementary and alternative therapies for testicular cancer

When you have cancer you are likely to hear about ways to treat your cancer or relieve symptoms that your doctor hasn't mentioned. Everyone from friends and family to Internet groups and Web sites offer ideas for what might help you. These methods can include vitamins, herbs, and special diets, or other methods such as acupuncture or massage, to name a few.

What exactly are complementary and alternative therapies?

Not everyone uses these terms the same way, and they are used to refer to many different methods, so it can be confusing. We use *complementary* to refer to treatments that are used *along with* your regular medical care. *Alternative* treatments are used *instead of* a doctor's medical treatment.

Complementary methods: Most complementary treatment methods are not offered as cures for cancer. Mainly, they are used to help you feel better. Some methods that are used along with regular treatment are meditation to reduce stress, acupuncture to help relieve pain, or peppermint tea to relieve nausea. Some complementary methods are known to help, while others have not been tested. Some have been proven not to be helpful, and a few have even been found to be harmful.

Alternative treatments: Alternative treatments may be offered as cancer cures. These treatments have not been proven safe and effective in clinical trials. Some of these methods may pose danger, or have life-threatening side effects. But the biggest danger in

most cases is that you may lose the chance to be helped by standard medical treatment. Delays or interruptions in your medical treatments may give the cancer more time to grow and make it less likely that treatment will help.

Finding out more

It is easy to see why people with cancer think about alternative methods. You want to do all you can to fight the cancer, and the idea of a treatment with no side effects sounds great. Sometimes medical treatments like chemotherapy can be hard to take, or they may no longer be working. But the truth is that most of these alternative methods have not been tested and proven to work in treating cancer.

As you consider your options, here are 3 important steps you can take:

- Look for "red flags" that suggest fraud. Does the method promise to cure all or most cancers? Are you told not to have regular medical treatments? Is the treatment a "secret" that requires you to visit certain providers or travel to another country?
- Talk to your doctor or nurse about any method you are thinking about using.
- Contact us at 1-800-227 -2345 to learn more about complementary and alternative methods in general and to find out about the specific methods you are looking at.

The choice is yours

Decisions about how to treat or manage your cancer are always yours to make. If you want to use a non-standard treatment, learn all you can about the method and talk to your doctor about it. With good information and the support of your health care team, you may be able to safely use the methods that can help you while avoiding those that could be harmful.

Treatment options for testicular cancer by stage

Stage 0 germ cell tumors

In this stage, the tumor in the testicle is carcinoma in situ (CIS), there is no cancer spread outside the testicle, and the levels of tumor markers (like HCG and AFP) are not elevated. If this stage was diagnosed after surgery to remove the testicle, no other treatment is needed. If the CIS was found after a testicular biopsy (like for fertility problems), the doctor may recommend that it not be treated right away. Instead, the patient may be watched closely with repeated physical exams, ultrasound of the testicle, and blood tests of tumor marker levels. Treatment may not be needed as long as there are no signs that the CIS is growing or turning into an invasive cancer. CIS can be treated with surgery (to remove the testicle) or with radiation therapy to the testicle. If tumor marker levels are high, the cancer is not really stage 0 – even when only CIS is found in the testicle and there are no signs of cancer spread. These cases are treated like stage IS cancers.

Stage I germ cell tumors

Stage I seminomas: These cancers are cured in more than 95% of patients. They are first treated by surgically removing the testicle and spermatic cord (radical inguinal orchiectomy). After surgery, several choices exist:

- **Radiation therapy:** Radiation aimed at para-aortic lymph nodes (in the back of the abdomen, around the large blood vessel called the aorta) is the most common next step. Because seminoma cells are very sensitive to radiation, low doses can be used, usually for about 10 to 15 treatments.

The doctor may recommend radiation therapy even though CT scan results do not show that the cancer has spread to the nodes. This is because in about 1 in 5 patients, cancerous cells have spread, but cannot be seen on imaging tests like CT scans. Radiation therapy is usually successful in destroying these hidden (occult) metastases.

- **Chemotherapy:** Another choice that works as well as radiation is to give 1 or 2 doses of chemotherapy (chemo) with the drug carboplatin after surgery.

- **Careful observation (surveillance):** Another approach to treating men with stage I seminomas is to not give radiation or chemo right after surgery, but instead to watch patients closely for 5 years. This means seeing the doctor and getting a physical exam and blood tests every 3 to 4 months for the first 2 years, with imaging studies (CT scans and sometimes chest x-rays) every 6 months during that time. Tests and exams are done less frequently over the next 3 years. If these tests do not find any signs that cancer has spread beyond the testicle, no additional treatment will be given. In about 15% to 20% of patients the cancer will come back as spread to lymph nodes or other organs, but if it does, radiation or chemo can still be used effectively to cure the cancer.

Some doctors decide whether or not to treat with chemo or radiation based on the size of the tumor and whether it invades nearby blood vessels. If the tumor is large or invades blood or lymph vessels, they may recommend treatment with either radiation or chemo.

Stage IS seminomas: In this stage, the level of one or more tumor markers is still high after the testicle containing the seminoma is removed. This is very rare, but is often treated with radiation.

Stage I non-seminomas: These cancers are also highly curable (about 98%), but the standard treatment is different from that of seminomas. As with seminomas, the initial treatment is surgery to remove the testicle and tumor (radical inguinal orchiectomy). Then the treatment choices depend on the stage.

For stage IA (T1) there are 2 choices:

- **Retroperitoneal lymph node dissection (RPLND):** This has the advantage of a high cure rate but the disadvantages of major surgery, with its complications and possibly losing the ability to ejaculate normally. After RPLND, if the nodes are found to have cancer in them, chemo may be recommended.

- **Careful observation (surveillance) for several years:** The advantage of surveillance is that there are no problems with surgery or chemotherapy side effects. The disadvantage is that you have to see the doctor a lot and get lots of x-rays and tests. For the first year, the doctor visits and blood tests are every 1 to 2 months, and the CT scans are every 3 to 4 months. In the second year, doctor visits and blood tests are every 2 months, with CT scans every 4 to 6 months. The length of time between visits gets longer each year. Without careful watching the cancer can come back (relapse) and can grow so large that it may not be curable. So far, this has not happened in men who saw their doctor for follow-up visits as scheduled. Most relapses occur in the first year after diagnosis, with most of the rest in the second year. Relapses are generally treated with chemo. Even though more patients will have a relapse with surveillance than with lymph node dissection, the cure rates are similar for both approaches because the relapses are usually found early enough to be cured.

For stage IB (T2, T3, or T4) there are up to 3 options:

- **Retroperitoneal lymph node dissection:** As in stage IA, chemo may be recommended after RPLND if cancer is found in the lymph nodes.
- **Careful observation (surveillance):** This requires frequent doctor visits and tests for several years. This is usually not an option if the tumor is T3 or T4 or for T2 tumors where the cancer cells were growing into blood or lymph vessels when the tumor was looked at under the microscope (called *vascular invasion*).
- **Chemotherapy:** The most common option is the BEP regimen (bleomycin, etoposide, and cisplatin) for 2 cycles. This option has a high cure rate but has the disadvantage of the side effects of chemo (mostly the short-term effects, since 2 cycles cause fewer long-term effects). This approach is more often used in Europe and less often used in the United States.

Stage IS non-seminoma: If the tumor marker levels (like AFP or HCG) are still high even after the testicle/tumor is removed, but no tumor is seen on a CT scan, chemo is recommended, either with either 3 cycles of BEP or 4 cycles of EP (etoposide and cisplatin).

Doctors have learned that certain features of the tumor mean that the cancer might come back. These depend on the blood test results and the way the cancer cells look under the microscope. If these features are present, doctors are less likely to recommend observation only.

Stage II germ cell tumors

Stage IIA seminomas: After surgery to remove the testicle (radical inguinal orchiectomy), these cancers are treated with radiation to the retroperitoneal lymph nodes. Usually higher doses of radiation are given for stage II seminomas than for stage I seminomas. If radiation can't be given for some reason, chemo may be used instead.

Stage IIB seminomas: All men will have radical inguinal orchiectomy to remove the testicle with the tumor. Treatment after surgery depends on the size of the retroperitoneal lymph nodes.

- If none of the lymph nodes are larger than 3 cm across, they are treated with radiation. (If radiation can't be given for some reason, chemo may be used instead.)
- If any of the lymph nodes are more than 3 cm across, though, chemo may be given instead. Either 4 cycles of EP (etoposide and cisplatin) or 3 cycles of BEP (bleomycin, etoposide, and cisplatin) may be used.

Stage IIc seminomas: These cancers are treated with radical inguinal orchiectomy, followed by 3 or 4 cycles of chemo with either EP or BEP. Radiotherapy is generally not used for stage IIc seminoma.

Stage II non-seminomas: Treatment for these tumors depends on the tumor markers and the retroperitoneal lymph nodes. All men will have radical inguinal orchiectomy to remove the testicle with the tumor. After surgery, there are 2 main options:

- **Retroperitoneal lymph node dissection (RPLND):** This may be followed by further treatment with chemo if the lymph nodes have cancer in them. Chemo is usually given for 2 cycles.
- **Chemotherapy:** Sometimes the doctor will recommend that the patient go straight to chemo (without doing the RPLND surgery). This is more likely to happen if the retroperitoneal lymph nodes are very large on the CT scan or if the tumor marker levels (HCG and/or AFP) are high even after the testicle with the tumor is removed. The chemo is usually given for 3 or 4 cycles.
After chemo, a CT scan is repeated to see if the retroperitoneal lymph nodes are still enlarged. If they are, they are removed by RPLND.

Stage III germ cell tumors

Both stage III seminomas and non-seminomas are treated with orchiectomy followed by chemo with a combination of drugs. The main regimens are the same as those used for stage II testicular cancers (usually BEP or EP) but at least 3 cycles of BEP or 4 cycles of EP are typically given. Patients with poor prognosis non-seminomas may receive 4 cycles of BEP. This treatment produces a cure in over 70% of cases.

Once chemo is complete, the doctor looks for any cancer that remains. Patients with normal scans and normal markers are usually watched carefully after this and may need no further treatment.

Sometimes a few tumors may remain. These are most often in the lung or in the retroperitoneal lymph nodes. Further treatment at this point depends on the type of cancer.

Seminomas: Tumors that remain after chemo but do not seem to still be growing are often observed with imaging tests. Results of the PET scan and the size of the tumor will influence the decision to continue follow-up with imaging tests and tumor markers or to

consider surgery and/or radiation therapy. Chemo with different drugs may be an option if these treatments don't work.

Non-seminomas: Residual tumors are usually removed surgically, which may result in a cure. Further chemo, but with different drugs, may also be an option. Patients whose cancer has metastasized to the brain usually receive chemo plus radiation therapy aimed at the brain, but surgery for the brain tumor is another option.

If the tumor marker levels are very high or the cancer is widespread then the usual chemo treatment may not always be enough. Sometimes the doctor may recommend high-dose chemotherapy followed by a stem cell transplant if regular chemo is not working. Patients might also want to consider enrolling in a clinical trial of newer chemo regimens. (For more information, see the section called "Clinical trials for testicular cancer.")

Recurrent germ cell tumors

If the cancer goes away with treatment and then comes back, it is said to have recurred or relapsed. Treatment of recurrent germ cell tumors depends on the initial stage and treatment. Cancer that comes back in the retroperitoneal lymph nodes can be treated by surgery (RPLND) if the recurrence is small (and if the only surgical treatment given before was orchiectomy). Depending on the results of the surgery, chemo may be recommended.

If it looks as if cancer has recurred in a lot of the retroperitoneal lymph nodes or if the cancer has returned elsewhere, then chemo is usually recommended. This may be followed by surgery.

If a man's cancer recurs after chemo or if his treatment is no longer working, he will be treated with different chemo regimens, which typically include ifosfamide, cisplatin, and either etoposide, paclitaxel, or vinblastine.

The treatment of testicular cancer that has come back after chemo is not always as effective as doctors would like. So some doctors may advise high-dose chemotherapy followed by a stem cell transplant. This may be a better option for men with recurrent disease, rather than standard chemo. (See the section called "High-dose chemotherapy and stem cell transplant for testicular cancer" for more information.)

In general, if chemo is no longer working, it is probably best to get a second opinion from a center of excellence with extensive experience in treating relapsed testicular cancer patients, before starting other treatments. Clinical trials can also be considered.

Sertoli cell and Leydig cell tumors

Radical inguinal orchiectomy is usually recommended for Sertoli cell and Leydig cell tumors. Radiation therapy and chemo are generally not effective in these rare types of testicular tumors. If the doctor suspects the tumor has metastasized beyond the testicle, the retroperitoneal lymph nodes may be surgically removed.

More treatment information for testicular cancer

For more details on treatment options -- including some that may not be addressed in this document -- the National Comprehensive Cancer Network (NCCN) and the National Cancer Institute (NCI) are good sources of information.

The NCCN, made up of experts from many of the nation's leading cancer centers, develops cancer treatment guidelines for doctors to use when treating patients. Those are available on the NCCN Web site (www.nccn.org).

The NCI provides treatment information via telephone (1-800-4-CANCER) and its Web site (www.cancer.gov). Information for patients as well as more detailed information intended for use by cancer care professionals is also available on www.cancer.gov.

The Lance Armstrong testicular cancer story

No one demonstrates better how far we have come in treating testicular cancer than Lance Armstrong. In 1996, this internationally-recognized bicycle racer began feeling a lowered energy level, started coughing blood, and had a painful testicle. He was found to have testicular cancer that had spread throughout his body to his lungs and brain.

After his testicle was removed, he received chemotherapy with cisplatin, etoposide, and ifosfamide (ifosfamide was used instead of bleomycin to avoid any damage to his lungs that would impair his bicycling). He also had surgery to remove 2 brain metastases (no radiation was given because of the concern that it also would affect his balance or coordination).

Lance completed his treatment by the end of that year, and by 1998, he was competing again. In 1999, he won the Tour de France, which some consider the most grueling athletic event in the world. He went on to win this event a record 7 consecutive times between 1999 and 2005. He also initiated **LIVESTRONG** (formerly the Lance Armstrong Foundation), a charitable organization dedicated to cure of cancer and coping with its consequences. You can read more information on the Lance Armstrong Foundation's Web site at www.livestrong.org.

What should you ask your doctor about testicular cancer?

As you deal with your cancer and the process of treatment, you need to have honest, open discussions with your cancer care team. You should feel free to ask any questions you might have, no matter how trivial they might seem. Among the questions you might want to ask are:

- What kind of testicular cancer do I have?
- Has my cancer spread beyond the primary site?
- What is the stage of my cancer? What does the staging mean in my case?

- Are there other tests that need to be done before we can decide on treatment?
- How much experience do you have treating this type of cancer?
- What treatment choices do I have?
- How many retroperitoneal node dissections have you done?
- What should I do to be ready for treatment?
- How long will treatment last? What will it involve? Where will it be done?
- How long will it take me to recover from treatment?
- When can I go back to work after treatment?
- What risks or possible side effects can I expect from my treatment?
- How soon after treatment can I have sex?
- What are the chances I will become infertile? Should I bank sperm?
- What are the chances that my cancer will recur? What would we do if that happens?
- Does one type of treatment reduce the risk of recurrence more than another?
- Should I get a second opinion before I start treatment, and when would a second opinion be helpful to me?

You will no doubt have other questions about your own personal situation. Be sure and write your questions down so you remember to ask them during each visit with your cancer care team. Keep in mind, too, that doctors are not the only ones who can give you information. Other health care professionals, such as nurses and social workers, may have the answers to your questions.

What happens after treatment for testicular cancer?

For most people with testicular cancer, treatment removes or destroys the cancer. Completing treatment can be both stressful and exciting. You may be relieved to finish treatment, but find it hard not to worry about cancer coming back. (When cancer comes back after treatment, it is called *recurrence*.) This is a very common concern in people who have had cancer.

It may take a while before your fears lessen. But it may help to know that many cancer survivors have learned to live with this uncertainty and are living full lives. Our document called *Living With Uncertainty: The Fear of Cancer Recurrence* gives more detailed information on this.

For a few people, the cancer may never go away completely. These people may get regular treatments with chemotherapy, radiation therapy, or other therapies to try to help keep the cancer in check. Learning to live with cancer that does not go away can be difficult and very stressful. It has its own type of uncertainty. Our document called *When Cancer Doesn't Go Away* talks more about this.

Follow-up care

When treatment ends, your doctors will still want to watch you closely. It is very important to go to all of your follow-up appointments. During these visits, your doctors will ask questions about any problems you may have and may do exams and lab tests or x-rays and scans to look for signs of cancer or treatment side effects. Almost any cancer treatment can have side effects. Some may last for a few weeks to months, but others can last the rest of your life. This is the time for you to talk to your cancer care team about any changes or problems you notice and any questions or concerns you have.

Follow-up care is extremely important after treatment of testicular cancer because even if it comes back, it is still often curable. That is why finding it early is so important.

Your health care team will explain what tests you need and how often they should be done. You will need frequent blood tests to measure levels of certain protein markers (alpha-fetoprotein [AFP], human chorionic gonadotropin [HCG], and lactate dehydrogenase [LDH]) to help detect relapse as early as possible. You will also need frequent x-rays, CT scans, and other imaging tests to look for recurrence, metastasis, or a new tumor. After a few years these appointments and tests will not have to be done as often. Depending on the type of treatment that you have had, you may also need specific follow-up for the possible complications of treatment.

Make a special effort to keep all appointments with your cancer care team and follow their instructions carefully. Report any new or recurring symptoms to your doctor right away. Most of the time, if the cancer comes back, it does so in the first 5 years. Still, there is always an outside chance the cancer can come back later. There is also about a 3% chance that men who have had cancer in one testicle will develop a new cancer in the other testicle., so men who have had testicular cancer should report any changes to their remaining testicle to their doctor.

Most men develop cancer in only one testicle. The remaining testicle usually can make enough testosterone (the male hormone) to keep the man healthy. If the other testicle needs to be removed because a new cancer develops, that man will need to take some form of testosterone the rest of his life. Most often this is in the form of a gel or patch that is applied to the skin or a monthly injection (given in a doctor's office). If you need testosterone supplements, talk to your doctor about what form is best for you.

Testicular cancer or its treatment can make a man infertile. Before treatment starts, men who wish to father children may want to consider storing sperm in a sperm bank for later use. Be aware, however, that the disease can cause low sperm counts, which may make it hard to obtain a good sample. In some cases, if one testicle remains, fertility returns temporarily or permanently after the testicular cancer has been treated successfully. For

example, fertility typically returns 2 years after chemotherapy stops. Even when sperm counts in semen are very low, men have several options for fathering children. One of these options is in vitro fertilization, in which an egg cell that has been removed from your partner's ovary is fertilized by your sperm cells in a laboratory and then returned to her uterus. Be sure to discuss any fertility concerns with your doctor before your treatment begins.

It is important to keep health insurance. Tests and doctor visits cost a lot, and even though no one wants to think of their cancer coming back, this could happen.

Should your cancer come back, our document called *When Your Cancer Comes Back: Cancer Recurrence* can give you information on how to manage and cope with this phase of your treatment.

Seeing a new doctor

At some point after your cancer diagnosis and treatment, you may find yourself seeing a new doctor who does not know anything about your medical history. It is important that you be able to give your new doctor the details of your diagnosis and treatment. Make sure you have the following information handy:

- A copy of your pathology report(s) from any biopsies or surgeries
- If you had surgery, a copy of your operative report(s)
- If you were hospitalized, a copy of the discharge summary that doctors prepare when patients are sent home
- If you had radiation therapy, a copy of the treatment summary
- If you had chemotherapy or other medicines, a list of your drugs, drug doses, and when you took them
- Copies of your CT scans (or other imaging tests) – these can often be placed on a DVD

The doctor may want copies of this information for his records, but always keep copies for yourself.

Lifestyle changes after having testicular cancer

You can't change the fact that you have had cancer. What you can change is how you live the rest of your life -- making choices to help you stay healthy and feel as well as you can. This can be a time to look at your life in new ways. Maybe you are thinking about how to improve your health over the long term. Some people even start during cancer treatment.

Making healthier choices

For many people, a diagnosis of cancer helps them focus on their health in ways they may not have thought much about in the past. Are there things you could do that might make you healthier? Maybe you could try to eat better or get more exercise. Maybe you could cut down on the alcohol, or give up tobacco. Even things like keeping your stress level under control may help. Now is a good time to think about making changes that can have positive effects for the rest of your life. You will feel better and you will also be healthier.

You can start by working on those things that worry you most. Get help with those that are harder for you. For instance, if you are thinking about quitting smoking and need help, call the American Cancer Society for information and support at 1-800-227-2345. This tobacco cessation and coaching service can help increase your chances of quitting for good.

Eating better

Eating right can be hard for anyone, but it can get even tougher during and after cancer treatment. Treatment may change your sense of taste. Nausea can be a problem. You may not feel like eating and lose weight when you don't want to. Or you may have gained weight that you can't seem to lose. All of these things can be very frustrating.

If treatment caused weight changes or eating or taste problems, do the best you can and keep in mind that these problems usually get better over time. You may find it helps to eat small portions every 2 to 3 hours until you feel better. You may also want to ask your cancer team about seeing a dietitian, an expert in nutrition who can give you ideas on how to deal with these treatment side effects.

One of the best things you can do after cancer treatment is put healthy eating habits into place. You may be surprised at the long-term benefits of some simple changes, like increasing the variety of healthy foods you eat. Getting to and staying at a healthy weight, eating a healthy diet, and limiting your alcohol intake may lower your risk for a number of types of cancer, as well as having many other health benefits.

Rest, fatigue, and exercise

Extreme tiredness, called *fatigue*, is very common in people treated for cancer. This is not a normal tiredness, but a "bone-weary" exhaustion that doesn't get better with rest. For some people, fatigue lasts a long time after treatment, and can make it hard for them to exercise and do other things they want to do. But exercise can help reduce fatigue. Studies have shown that patients who follow an exercise program tailored to their personal needs feel better physically and emotionally and can cope better, too.

If you were sick and not very active during treatment, it is normal for your fitness, endurance, and muscle strength to decline. Any plan for physical activity should fit your own situation. An older person who has never exercised will not be able to take on the

same amount of exercise as a 20-year-old who plays tennis twice a week. If you haven't exercised in a few years, you will have to start slowly – maybe just by taking short walks.

Talk with your health care team before starting anything. Get their opinion about your exercise plans. Then, try to find an exercise buddy so you're not doing it alone. Having family or friends involved when starting a new exercise program can give you that extra boost of support to keep you going when the push just isn't there.

If you are very tired, you will need to balance activity with rest. It is OK to rest when you need to. Sometimes it's really hard for people to allow themselves to rest when they are used to working all day or taking care of a household, but this is not the time to push yourself too hard. Listen to your body and rest when you need to. (For more information on dealing with fatigue, please see our documents called *Fatigue in People With Cancer* and *Anemia in People With Cancer*.)

Keep in mind exercise can improve your physical and emotional health.

- It improves your cardiovascular (heart and circulation) fitness.
- Along with a good diet, it will help you get to and stay at a healthy weight.
- It makes your muscles stronger.
- It reduces fatigue and helps you have more energy.
- It can help lower anxiety and depression.
- It can make you feel happier.
- It helps you feel better about yourself.

And long term, we know that getting regular physical activity plays a role in helping to lower the risk of some cancers, as well as having other health benefits.

How does having testicular cancer affect your emotional health?

When treatment ends, you may find yourself overcome with many different emotions. This happens to a lot of people. You may have been going through so much during treatment that you could only focus on getting through each day. Now it may feel like a lot of other issues are catching up with you.

You may find yourself thinking about death and dying. Or maybe you're more aware of the effect the cancer has on your family, friends, and career. You may take a new look at your relationship with those around you. Unexpected issues may also cause concern. For instance, as you feel better and have fewer doctor visits, you will see your health care team less often and have more time on your hands. These changes can make some people anxious.

Almost everyone who has been through cancer can benefit from getting some type of support. You need people you can turn to for strength and comfort. Support can come in

many forms: family, friends, cancer support groups, church or spiritual groups, online support communities, or one-on-one counselors. What's best for you depends on your situation and personality. Some people feel safe in peer-support groups or education groups. Others would rather talk in an informal setting, such as church. Others may feel more at ease talking one-on-one with a trusted friend or counselor. Whatever your source of strength or comfort, make sure you have a place to go with your concerns.

The cancer journey can feel very lonely. It is not necessary or good for you to try to deal with everything on your own. And your friends and family may feel shut out if you do not include them. Let them in, and let in anyone else who you feel may help. If you aren't sure who can help, call your American Cancer Society at 1-800-227-2345 and we can put you in touch with a group or resource that may work for you.

If treatment for testicular cancer stops working

If cancer keeps growing or comes back after one kind of treatment, it is possible that another treatment plan might still cure the cancer, or at least shrink it enough to help you live longer and feel better. But when a person has tried many different treatments and the cancer has not gotten any better, the cancer tends to become resistant to all treatment. If this happens, it's important to weigh the possible limited benefits of a new treatment against the possible downsides. Everyone has their own way of looking at this.

This is likely to be the hardest part of your battle with cancer -- when you have been through many medical treatments and nothing's working anymore. Your doctor may offer you new options, but at some point you may need to consider that treatment is not likely to improve your health or change your outcome or survival.

If you want to continue to get treatment for as long as you can, you need to think about the odds of treatment having any benefit and how this compares to the possible risks and side effects. In many cases, your doctor can estimate how likely it is the cancer will respond to treatment you are considering. For instance, the doctor may say that more chemo or radiation might have about a 1% chance of working. Some people are still tempted to try this. But it is important to think about and understand your reasons for choosing this plan.

No matter what you decide to do, you need to feel as good as you can. Make sure you are asking for and getting treatment for any symptoms you might have, such as nausea or pain. This type of treatment is called *palliative care*.

Palliative care helps relieve symptoms, but is not expected to cure the disease. It can be given along with cancer treatment, or can even be cancer treatment. The difference is its purpose - the main purpose of palliative care is to improve the quality of your life, or help you feel as good as you can for as long as you can. Sometimes this means using drugs to help with symptoms like pain or nausea. Sometimes, though, the treatments used to control your symptoms are the same as those used to treat cancer. For instance, radiation might be used to help relieve bone pain caused by cancer that has spread to the bones. Or

chemo might be used to help shrink a tumor and keep it from blocking the bowels. But this is not the same as treatment to try to cure the cancer.

At some point, you may benefit from hospice care. This is special care that treats the person rather than the disease; it focuses on quality rather than length of life. Most of the time, it is given at home. Your cancer may be causing problems that need to be managed, and hospice focuses on your comfort. You should know that while getting hospice care often means the end of treatments such as chemo and radiation, it doesn't mean you can't have treatment for the problems caused by your cancer or other health conditions. In hospice the focus of your care is on living life as fully as possible and feeling as well as you can at this difficult time. You can learn more about hospice in our document called *Hospice Care*.

Staying hopeful is important, too. Your hope for a cure may not be as bright, but there is still hope for good times with family and friends -- times that are filled with happiness and meaning. Pausing at this time in your cancer treatment gives you a chance to refocus on the most important things in your life. Now is the time to do some things you've always wanted to do and to stop doing the things you no longer want to do. Though the cancer may be beyond your control, there are still choices you can make.

What's new in testicular cancer research and treatment?

Important research into testicular cancer is being done in many university hospitals, medical centers, and other institutions around the country. Each year, scientists find out more about what causes the disease, how to prevent it, and how to improve treatment.

Recently, researchers have found inherited variations in two genes called c-KIT ligand (KITLG) and sprouty 4 (SPRY4) that appear to increase a man's risk of developing testicular cancer. Another study found that variants of 3 other genes, DMRT1, TERT, and ATF71P, may also increase the risk of testicular cancer. These findings may help identify men at higher risk, but they need to be studied much more.

Scientists are also studying the changes in DNA of testicular cancer cells to learn more about the causes of this disease. Their hope is that improved understanding will lead to even more effective treatment. Certain gene mutations found in the testicular cancer cells have been linked to resistance to chemotherapy and predict poor outcomes. These findings may help individualize treatment better and help find new drugs to treat testicular cancer that can target these gene mutations. A better understanding of the genetic changes will help doctors decide which patients need further treatment and which can be safely treated with surgery alone.

Clinical trials have refined doctors' approaches to treating these cancers and are expected to answer additional questions. For example, studies have identified factors to help predict which patients have a particularly good prognosis and may not need lymph node surgery or radiation therapy. Studies also have found unfavorable prognostic factors that suggest certain patients may benefit from more intensive treatment.

A large amount of work is being done to try to limit the long-term toxicities of treatment while maintaining the cure rate. Doctors want to be able to predict better whose cancer is more likely to recur and then base the amount of therapy on this, thereby not under- or over- treating anyone. One study reported good results by individualizing treatment in men with metastatic testicular cancer based on the decline of tumor marker (AFP and HCG) levels after chemo, giving more intense treatment to those with a slower decline.

New drugs and new drug combinations are being tested for patients with recurrent cancer. Stem cell transplantation is being studied as a strategy for helping men who have tumors with a poor prognosis tolerate more intensive chemo. And chemo combinations are being refined to see if eliminating certain drugs, replacing them with others, or lowering doses can reduce side effects for some men without reducing the effectiveness of treatment.

As more and more young men are surviving testicular cancer, fertility has become an increasingly important consideration. Advances in assisted reproduction methods such as in vitro fertilization have made fatherhood possible for testicular cancer survivors, even if their sperm counts are extremely low. In some cases, sperm cells removed from a testicular biopsy specimen can be successful when other options have failed.

Additional resources for testicular cancer

More information from your American Cancer Society

We have some related information that may also be helpful to you. These materials may be ordered from our toll-free number, 1-800-227-2345.

After Diagnosis: A Guide for Patients and Families (also available in Spanish)

Bone Marrow and Peripheral Blood Stem Cell Transplants

Do I Have Testicular Cancer?

Sexuality for the Man With Cancer (also available in Spanish)

Understanding Chemotherapy: A Guide for Patients and Families (also available in Spanish)

Understanding Radiation Therapy: A Guide for Patients and Families (also available in Spanish)

Books

Your American Cancer Society also has books that you might find helpful. Call us at 1-800-227-2345 or visit our bookstore online to find out about costs or to place an order.

National organizations and Web sites*

In addition to the American Cancer Society, other sources of patient information and support include:

LIVESTRONG (formerly the Lance Armstrong Foundation)

Toll-free number: 1-866-235-7205

Web site: www.livestrong.org

National Cancer Institute

Toll-free number: 1-800-4-CANCER (1-800-422-6237)

Web site: www.cancer.gov

Testicular Cancer Resource Center

Web site: <http://tcrc.acor.org>

**Inclusion on this list does not imply endorsement by the American Cancer Society.*

No matter who you are, we can help. Contact us anytime, day or night, for information and support. Call us at 1-800-227-2345 or visit www.cancer.org.

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Last Medical Review: 5/4/2012

Last Revised: 5/14/2012

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