



## THYROID CANCER

### What is cancer?

The body is made up of hundreds of millions 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.

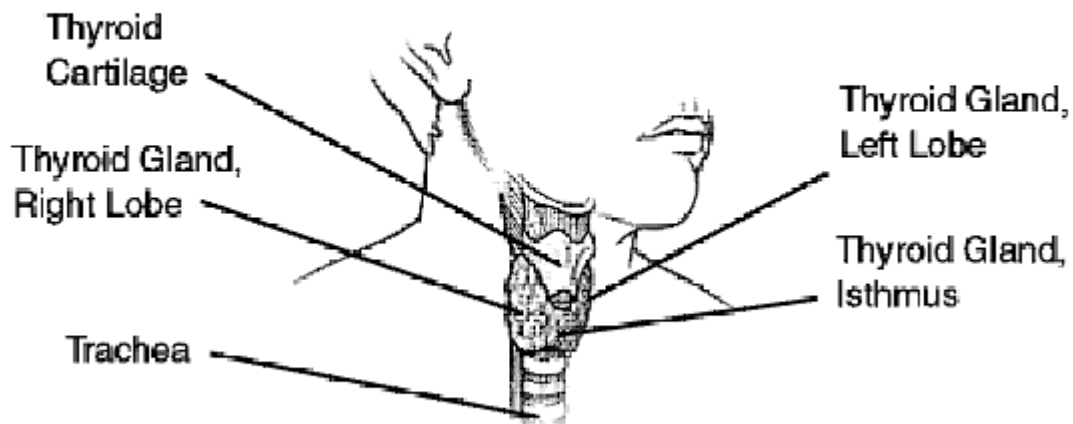
Not all tumors are cancerous. Tumors that aren't cancer are called benign. Benign tumors can cause problems -- they can grow very large and press on healthy organs and tissues. But they cannot grow into (invade) other tissues. Because they can't invade, they also can't spread to other parts of the body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

## **What is thyroid cancer?**

Thyroid cancer is a cancer that starts in the thyroid gland. To understand thyroid cancer, it helps to know about the normal structure and function of the thyroid gland.

### **The thyroid gland**

The thyroid gland is under the Adam's apple in the front part of the neck. In most people, it cannot be seen or felt. It is butterfly shaped, with 2 lobes -- the right lobe and the left lobe -- joined by a narrow isthmus (see picture below)



The thyroid gland contains mainly 2 types of cells -- *thyroid follicular cells* and *C cells* (also called *parafollicular cells*).

The follicular cells use iodine from the blood to make thyroid hormone, which helps regulate a person's metabolism. Too much thyroid hormone (a condition called *hyperthyroidism*) can cause a rapid or irregular heartbeat, trouble sleeping, nervousness, hunger, weight loss, and a feeling of being too warm. Too little hormone (called *hypothyroidism*) causes a person to slow down, feel tired, and gain weight. The amount of thyroid hormone released by the thyroid is regulated by the pituitary gland at the base of the brain, which makes a substance called *thyroid-stimulating hormone (TSH)*.

C cells (parafollicular cells) make calcitonin, a hormone that helps regulate how the body uses calcium.

Other, less common cells in the thyroid gland include immune system cells (lymphocytes) and supportive (stromal) cells.

Different cancers develop from each kind of cell. The differences are important because they affect how serious the cancer is and what type of treatment is needed.

Many types of tumors can develop in the thyroid gland. Most of them are benign (non-cancerous) but others are malignant (cancerous), which means they can spread into nearby tissues and to other parts of the body.

## Benign thyroid enlargement and nodules

Because the thyroid gland is right under the skin, changes in its size and shape can often be felt or even seen by patients or by their doctor.

The medical term for an abnormally large thyroid gland is *goiter*. Some goiters are diffuse, meaning that the whole gland is large. Other goiters are nodular, meaning that the gland is large and has one or more bumps in it. There are many reasons the thyroid gland might be larger than usual, and most of the time it is not cancer. Both kinds of goiter are usually caused by an imbalance in certain hormones. For example, not getting enough iodine in the diet can cause changes in hormone levels and lead to a goiter.

Lumps or bumps in the thyroid gland are called *thyroid nodules*. Most thyroid nodules are benign, but about 1 in 20 is cancerous (see the next section).

People can develop thyroid nodules at any age, but they are most common in older adults. Fewer than 1 in 10 adults have thyroid nodules that can be felt by a doctor. But when the thyroid is looked at in an ultrasound test, up to half of all people are found to have nodules that are too small to feel.

Most nodules are cysts filled with fluid or with a stored form of thyroid hormone called colloid. Colloid nodules are one of the most common types of thyroid nodule.

Solid nodules have little fluid or colloid. Some solid nodules may have too many cells, but the cells are not cancer cells. These types of nodules include hyperplastic nodules and adenomas. Sometimes these nodules make too much thyroid hormone and cause hyperthyroidism.

Benign thyroid nodules can sometimes be left alone (instead of treating them) as long as they're not growing or causing symptoms. Others may require some form of treatment.

## Malignant thyroid tumors

Only about 1 in 20 thyroid nodules is cancerous. The 2 most common types of thyroid cancer are called *papillary carcinoma* and *follicular carcinoma*. *Hürthle cell carcinoma* is a subtype of follicular carcinoma. All these types are differentiated tumors. There are some other types of thyroid cancer, such as *medullary thyroid carcinoma*, *anaplastic carcinoma*, and *thyroid lymphoma*, but these occur less often.

### Differentiated thyroid cancers

Differentiated thyroid cancers develop from thyroid follicular cells. In these cancers, the cells appear similar to normal thyroid tissue when looked at under a microscope.

**Papillary carcinoma:** About 8 of 10 thyroid cancers are papillary carcinomas (also called *papillary cancers* or *papillary adenocarcinomas*). Papillary carcinomas typically grow very slowly. Usually they develop in only one lobe of the thyroid gland, but sometimes they occur in both lobes. Even though they grow slowly, papillary carcinomas often spread to the lymph nodes in the neck. But most of the time, this can be successfully treated and is rarely fatal.

Several different variants (subtypes) of papillary carcinoma can be recognized under the microscope. Of these, the follicular variant (also called *mixed papillary-follicular variant*) occurs most often. The usual form of papillary carcinoma and the follicular variant have the same outlook for survival (prognosis), and treatment is the same for both. Other variants of papillary carcinoma (columnar, tall cell, diffuse sclerosis) are not as common and tend to grow and spread more quickly.

**Follicular carcinoma:** Follicular carcinoma is the next most common type of thyroid cancer. It is also sometimes called *follicular cancer* or *follicular adenocarcinoma*. Follicular cancer is much less common than papillary thyroid cancer, making up about 1 out of 10 thyroid cancers. It is more common in countries where people don't get enough iodine in their diet. These cancers usually remain in the thyroid gland. Unlike papillary carcinoma, follicular carcinomas usually don't spread to lymph nodes, but some can spread to other parts of the body, such as the lungs or bones. The prognosis for follicular carcinoma is probably not quite as good as that of papillary carcinoma, although it is still very good in most cases.

**Hürthle cell carcinoma**, also known as *oxyphil cell carcinoma*, is actually a kind of follicular carcinoma. This type accounts for about 4% of thyroid cancers. The prognosis may not be as good as that of typical follicular carcinoma because this subtype is harder to find and treat as it is less likely to absorb radioactive iodine. Radioactive iodine is used for treatment and to find metastases of differentiated thyroid cancer.

### Other types of thyroid cancers

**Medullary thyroid carcinoma:** Medullary thyroid carcinoma (MTC) accounts for about 5% of thyroid cancers. It develops from the C cells of the thyroid gland. Sometimes this cancer can spread to lymph nodes, the lungs, or liver even before a thyroid nodule is discovered. These cancers usually make *calcitonin* and *carcinoembryonic antigen (CEA)*, which can be found by blood tests. Calcitonin is a hormone that helps control the amount of calcium in blood. CEA is a protein made by certain cancers, such as colorectal cancer and MTC. Because medullary cancer does not absorb or take up radioactive iodine (used for treatment and to find metastases of differentiated thyroid cancer), the prognosis (outlook) is not quite as good as that for differentiated thyroid cancers.

There are 2 types of MTC. The first type, occurring in about 8 of 10 cases, is called *sporadic MTC*. Sporadic MTC is not inherited; that is, it does not run in families. It occurs mostly in older adults and in only 1 thyroid lobe.

The other type of MTC is inherited and can occur in each generation of a family. These *familial MTCs* often develop during childhood or early adulthood and can spread early. Patients usually have cancer in both thyroid lobes and in several areas of each lobe. They are often linked with an increased risk of other types of tumors. This is described in more detail in the section "What are the risk factors for thyroid cancer?"

**Anaplastic carcinoma:** Anaplastic carcinoma (also called *undifferentiated carcinoma*) is a rare form of thyroid cancer, making up about 2% of all thyroid cancers. It is thought to sometimes develop from an existing papillary or follicular cancer. This cancer is called undifferentiated because the cancer cells do not look very much like normal thyroid tissue cells under the microscope. This is an aggressive cancer that rapidly invades the neck, often spreads to other parts of the body, and is very hard to treat.

**Thyroid lymphoma:** Lymphoma is very uncommon in the thyroid gland. Lymphomas are cancers that develop from lymphocytes, the main cell type of the immune system. Most lymphocytes are found in lymph nodes, which are pea-sized collections of immune cells scattered throughout the body (including the thyroid gland). Lymphomas are discussed in the separate American Cancer Society document, *Non-Hodgkin Lymphoma*.

**Thyroid sarcoma:** These rare cancers start in the supporting cells of the thyroid. They are often aggressive and hard to treat. Sarcomas are discussed in the separate American Cancer Society document, *Sarcoma: Adult Soft Tissue Cancer*.

## Parathyroid cancer

Behind, but attached to, the thyroid gland are 4 tiny glands called the parathyroids. The parathyroid glands help regulate the body's calcium levels. Cancers of the parathyroid glands are very rare -- there are probably fewer than 100 cases each year in the United States.

Parathyroid cancers cause the blood calcium level to be elevated. This causes a person to become tired, weak, and drowsy. High calcium also makes you urinate (pee) a lot causing dehydration, which can make the weakness and drowsiness worse. Other symptoms include bone pain and fractures, pain from kidney stones, depression, and constipation.

Larger parathyroid cancers may also be detected as a nodule near the thyroid. No matter how large the nodule is, the only treatment is to remove it surgically. Unfortunately, parathyroid cancer is much harder to cure than thyroid cancer. The remainder of this document only discusses thyroid cancer.

## What are the key statistics about thyroid cancer?

The American Cancer Society's most recent estimates for thyroid cancer in the United States are for 2009:

- about 37,200 new cases of thyroid cancer (27,200 in women, and 10,000 in men)
- 1,630 deaths (940 women and 690 men).

In general, this is one of the least deadly cancers. The 5-year survival rate (the percentage of people living *at least* 5 years after being diagnosed) for all cases is about 97%. (Statistics on survival rates by type and stage of thyroid cancer are discussed in the section, "How is thyroid cancer staged?")

Thyroid cancer is different from many other adult cancers in that it mainly affects younger people. Nearly 2 of 3 cases are found in people between the ages of 20 and 55.

The chance of being diagnosed with thyroid cancer has risen slightly in recent years. Most of this is thought to be the result of the increased use of thyroid ultrasound, which detects small thyroid nodules that might not otherwise have been found. Most of the increase is from finding more small papillary cancers, which are rarely fatal. The death rate from thyroid cancer has been fairly stable for many years.

## **What are the risk factors for thyroid cancer?**

A risk factor is anything that affects a person's 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 a number of cancers.

But risk factors don't tell us everything. Having a risk factor, or even several risk factors, does not mean that you will get the disease. And many people who get the disease may not have had any known risk factors. Even if a person with thyroid cancer has a risk factor, it is very hard to know how much that risk factor may have contributed to the cancer.

Scientists have found a few risk factors that make a person more likely to develop thyroid cancer.

### **Gender and age**

For unclear reasons thyroid cancers occur about 3 times more often in women than in men.

Thyroid cancers can occur in people of all ages, but most cases of papillary and follicular thyroid cancer are found in people between the ages of 20 and 60 years.

## **A diet low in iodine**

Follicular thyroid cancers are more common in areas of the world where people's diets are low in iodine. In the United States, dietary iodine is plentiful because iodine is added to table salt and other foods. A diet low in iodine may also increase the risk of papillary cancer if the person also is exposed to radioactivity.

## **Radiation**

Exposure to radiation is a proven risk factor for thyroid cancer. Sources of such radiation include certain medical treatments and radiation fallout from power plant accidents or nuclear weapons.

Having had head or neck radiation treatments in childhood is a risk factor for thyroid cancer. In the past, children were sometimes treated with radiation for things we wouldn't use radiation for now, like acne, fungus infections of the scalp (ringworm), an enlarged thymus gland, or to shrink tonsils or adenoids. Years later, studies linked these treatments to an increased risk of thyroid cancer. Radiation therapy in childhood for some cancers such as Hodgkin disease also increases risk. In general, the risk is higher in children who were younger when the treatment was given. Being exposed to radiation as an adult carries little risk of thyroid cancer.

Thyroid cancers associated with prior radiation therapy are not more serious than other thyroid cancers.

Several studies have pointed to an increased risk of thyroid cancer in children because of radioactive fallout from nuclear weapons or power plant accidents. For instance, thyroid cancer is several times more common than normal in children living near Chernobyl, the site of a 1986 nuclear plant accident that exposed millions of people to radioactivity. Adults involved with the cleanup after the accident and those who lived near the plant have also had a higher rate of thyroid cancer. Children with more iodine in their diet appeared to have a lower risk.

Some radioactive fallout occurred over certain regions of the United States after nuclear weapons were tested in western states during the 1950s. This exposure was much, much lower than that around Chernobyl. A higher risk of thyroid cancer has not been proven at these low exposure levels. If you are concerned about possible exposure to radioactive fallout, discuss this with your doctor.

## **Hereditary conditions**

Several inherited conditions have been linked to different types of thyroid cancer.

**Medullary thyroid cancer:** About 1 out of 5 medullary thyroid carcinomas (MTCs) result from inheriting an abnormal gene. These cases are known as *familial medullary thyroid carcinoma* (FMTC). FMTC can occur alone, or it can be seen along with other tumors.

The combination of FMTC and tumors of other endocrine glands is called *multiple endocrine neoplasia type 2* (MEN 2). There are 2 subtypes, MEN 2a and MEN 2b:

- In MEN 2a, MTC occurs along with pheochromocytomas (tumors in the adrenal glands, which are located on top of the kidneys) and with parathyroid gland tumors.
- In MEN 2b, MTC is associated with pheochromocytomas and with benign growths of nerve tissue on the tongue and elsewhere called neuromas. This subtype is much less common than MEN 2a.

In these inherited forms of MTC, the cancers often develop during childhood or early adulthood and can spread early. MTC is most aggressive in the MEN 2b syndrome. If MEN 2a, MEN 2b, or isolated FMTC runs in your family, then you may be at very high risk of developing MTC. Ask your doctor for information about having regular blood tests or ultrasound exams to look for problems and the possibility of genetic testing.

**Other thyroid cancers:** People with certain inherited medical conditions are at higher risk for more common forms of thyroid cancer. Higher rates of the disease occur among people with uncommon genetic conditions such as *Gardner syndrome*, *Cowden disease*, and *familial adenomatous polyposis (FAP)*. If you suspect you may have a familial condition, discuss it with your doctor who may recommend genetic counseling if your medical history warrants it.

Papillary and follicular thyroid cancers do seem to run in some families without a known inherited syndrome; this may account for about 5% of thyroid cancers. The genetic basis for these cancers is not totally clear.

## Do we know what causes thyroid cancer?

Although scientists have found that thyroid cancer is linked with a number of other conditions (described in the section, "What are the risk factors for thyroid cancer?"), the exact cause of most thyroid cancers is not yet known.

Researchers have made great progress in understanding how certain changes in a person's DNA can cause thyroid cells to become cancerous. DNA is the chemical in each of our cells that makes up our *genes* -- the instructions for how our cells function. We usually resemble our parents because they are the source of our DNA. However, DNA affects more than how we look. It also can influence our risk for developing certain diseases, including some kinds of cancer.

Some genes contain instructions for controlling when our cells grow and divide. Certain genes that speed up cell division or cause cells to live longer than they should are called *oncogenes*. Others that slow down cell division or cause cells to die at the appropriate time are called *tumor suppressor genes*. Cancers can be caused by DNA mutations (defects) that turn on oncogenes or turn off tumor suppressor genes.

People inherit 2 copies of each gene -- one from each parent. People can inherit damaged DNA from one or both parents, which accounts for inherited cancers. Most cancers, though, are not inherited. In these cases, a person's DNA is damaged by exposure to something in the environment, like smoking or radiation. Sometimes DNA mutates for no apparent reason.

### **Papillary thyroid cancer**

Several DNA mutations have been found in some forms of papillary thyroid cancer. Many of these cancers have changes in specific parts of the *RET* gene. The altered form of this gene, known as the *PTC* oncogene, is found in about 10% to 30% of papillary thyroid cancers overall, and in a larger percentage of these cancers found in children and/or linked with radiation exposure. These *RET* mutations usually are acquired during a person's lifetime rather than being inherited. They are present only in the cancer cell and are not passed on to the patient's children.

Many (30% to 70%) papillary thyroid cancers contain a mutation of the *BRAF* gene. The *BRAF* mutation is less common in thyroid cancers in children and in those thought to arise from exposure to radiation. Cancers with *BRAF* changes tend to have more aggressive growth and a greater likelihood of spreading to other parts of the body.

Both *BRAF* and *RET/PTC* changes are thought to cause cells to grow and divide. It is extremely rare for papillary cancers to have changes in both the *BRAF* and *RET/PTC* genes.

Changes to other genes have also been tied to papillary thyroid cancer, including those in the *NTRK1* gene and the *MET* gene.

### **Follicular thyroid cancer**

Acquired changes in the *RAS* oncogene have a role in causing follicular thyroid cancers.

### **Anaplastic thyroid cancer**

These cancers tend to have some of the mutations described above, and often have changes in the *p53* tumor suppressor gene as well.

## **Medullary thyroid cancer**

People who have medullary thyroid carcinoma (MTC) have mutations in different parts of the *RET* gene compared with papillary carcinoma patients. Nearly all patients with the inherited form of MTC and about 1 of every 5 with the sporadic (non-inherited) form of MTC have a mutation in the *RET* gene. Most patients with sporadic MTC have acquired mutations present only in their cancer cells. Those with familial MTC and MEN 2 inherit the *RET* mutation from a parent. These mutations are present in every cell of the patient's body and can be detected by testing the DNA of blood cells.

In people with inherited mutations of *RET*, one *RET* gene is usually normal and one is mutated. Because every person has 2 *RET* genes but passes only 1 to a child (the child's other *RET* gene comes from the other parent), the odds that a person with familial MTC will pass a mutated gene on to a child are 1 in 2 (or 50%).

## **Can thyroid cancer be prevented?**

Most people with thyroid cancer have no known risk factors, so it is not possible to prevent most cases of this disease.

Radiation exposure, especially in childhood, is a known risk factor for thyroid cancer. Because of this, doctors no longer use radiation treatment for less serious diseases. In general, it is a good idea for children to avoid any x-rays that aren't necessary.

Genetic blood tests now available to test for the mutations found in familial medullary thyroid carcinoma (MTC). Because of this, most of the familial cases of MTC can be prevented or treated early by removing the thyroid gland. Once the disease is discovered in a family, the rest of the family members can be tested for the mutated gene.

If you have a family history of MTC, it is important that you see a doctor who is familiar with the latest advances in genetic counseling and genetic testing for this disease. Removing the thyroid gland in children who carry the abnormal gene will prevent a cancer that might otherwise be fatal.

## **Can thyroid cancer be found early?**

Many cases of thyroid cancer can be found early. In fact, most thyroid cancers are now found much earlier than in the past and can be treated successfully. Most early thyroid cancers are found when patients ask their doctors about lumps or nodules they have noticed. Others are

found by health care professionals during a routine checkup. Although it's unusual, some thyroid cancers may not cause symptoms until after they reach an advanced stage.

If you have unusual symptoms such as a lump or swelling in your neck, you should make an appointment to see your doctor right away. During routine physical exams, be sure your doctor does a cancer-related checkup that includes an examination of the thyroid. Some doctors recommend that people examine their own necks twice a year to look for any growths or lumps.

Early thyroid cancers are sometimes found when people have ultrasound tests for other health problems, such as narrowing of carotid arteries (which pass through the neck to supply blood to the brain) or for enlarged or overactive parathyroid glands. Although blood tests or thyroid ultrasound often find changes in the thyroid, these tests are not recommended for early detection unless there is a reason (such as family history) to suspect a person is at increased risk for thyroid cancer.

People with a family history of medullary thyroid carcinoma (MTC) with or without type 2 multiple endocrine neoplasia (MEN 2) may be at very high risk for developing this cancer. Most doctors recommend genetic testing for these people when they are young to see if they carry the gene changes linked to MTC. For people who may be at risk but don't get genetic testing, blood tests are available that can help find MTC at an early stage when it may still be curable. Thyroid ultrasounds may also be done in high risk people.

## **How is thyroid cancer diagnosed?**

### **Signs and symptoms of thyroid cancer**

Prompt attention to signs and symptoms is the best way to diagnose most thyroid cancers early. Thyroid cancer can cause any of the following local signs or symptoms:

- a nodule, lump, or swelling in the neck, sometimes growing rapidly
- a pain in the front of the neck, sometimes going up to the ears
- hoarseness or other voice changes that do not go away
- trouble swallowing
- breathing problems (feeling as if one were "breathing through a straw")
- a cough that continues and is not due to a cold

If you have any of these signs or symptoms, talk to your doctor right away. Many non-cancerous conditions (and some other cancers of the neck area) can cause some of the same symptoms. Thyroid nodules are common and are usually benign. But the only way to find out for sure is to have a medical evaluation. The sooner you receive a correct diagnosis, the sooner you can start treatment and the more effective your treatment will be.

## Medical history and physical exam

If you have any signs or symptoms that suggest you might have thyroid cancer, your health care professional will want to take a complete medical history. You will be asked questions about your possible risk factors, symptoms, and any other health problems or concerns. If someone in your family has had thyroid cancer (especially medullary thyroid cancer) or adrenal gland tumors called *pheochromocytomas*, it is important to tell your doctor, as this might indicate you are at high risk for this disease.

A physical exam will give more information about signs of thyroid cancer and other health problems. During the exam, your doctor will pay special attention to the size and firmness of your thyroid and any enlarged lymph nodes in your neck.

## Fine needle aspiration biopsy

The actual diagnosis of thyroid cancer is made from the results of a biopsy, in which cells from the suspicious area are removed and looked at under a microscope. The simplest way to find out if a thyroid lump or nodule is cancerous is with a fine needle aspiration (FNA) of the thyroid nodule.

This type of biopsy can usually be done in your doctor's office or clinic. Your doctor will place a thin, hollow needle directly into the nodule to take out cells and a few drops of fluid (aspirate) into a syringe. The doctor usually repeats this procedure 2 or 3 times during the same appointment to take samples from several areas of the nodule. The cells can then be viewed under a microscope to see if they look cancerous or benign.

Before the biopsy, local anesthesia (numbing medicine) may be injected into the skin over the nodule, but in some cases an anesthetic may not be needed at all. A potential complication of the biopsy is prolonged bleeding, but this is rare except in people with bleeding disorders. Be sure to tell your doctor if you have a bleeding disorder.

This test is generally done on all thyroid nodules that are big enough to be felt. This means that they are larger than about 1 centimeter (about 1/2 inch) across. If a nodule is too small for the doctor to feel, sometimes FNA biopsies can be done using an ultrasound machine to help the doctor find the right place to put the needle.

About 2 tests in every 10 may need to be repeated because the sample ends up not containing enough cells. About 7 of 10 FNA biopsies will show that the nodule is benign. Cancer is clearly diagnosed in only 1 of every 20 FNA biopsies.

Sometimes the test results come back as suspicious or atypical. This happens when the FNA findings can't say for sure if the nodule is benign or malignant. In these cases, a more

involved biopsy may be needed to get a better sample, particularly if the doctor has reason to think the nodule may be cancerous. This might include a biopsy using a larger needle, or a surgical "open" biopsy or a lobectomy (removal of the gland on one side of the windpipe). Surgical biopsies are done in an operating room while you are under general anesthesia (in a deep sleep).

## **Imaging tests**

Imaging tests may be done for a number of reasons, including to find out whether a suspicious area might be cancerous, to learn how far the cancer may have spread, and to help determine if treatment has been effective.

### **Chest x-ray**

A plain x-ray of your chest may be done to see if cancer has spread to your lungs, especially if you have follicular thyroid cancer.

### **Ultrasound**

Ultrasound, or sonography, uses sound waves to create images of your body. For this test, a small, microphone-like instrument called a transducer is placed on the skin in front of your thyroid gland. It emits sound waves and picks up the echoes as they bounce off the thyroid. The echoes are converted by a computer into a black and white image that is displayed on a computer screen. You are not exposed to radiation during this test.

This test is helpful in determining if a thyroid nodule is solid or filled with fluid. It can also be used to check the number and size of thyroid nodules. Ultrasound features can sometimes suggest a nodule is likely to be cancerous, but can't predict malignancy for certain. For thyroid nodules that are too small to be felt, this test can be used to guide a biopsy needle into the nodule to obtain a sample. Even when a nodule is large enough to feel, some doctors prefer to use ultrasound to guide the needle.

Ultrasound can also help determine whether any nearby lymph nodes are enlarged because the thyroid cancer has spread. Many thyroid specialists recommend ultrasound for all patients with thyroid nodules large enough to feel.

### **Computed tomography**

The computed tomography (CT or CAT) scan is an x-ray test that produces detailed cross-sectional images of your body. Instead of taking one picture, like a regular x-ray, a CT scanner takes many pictures as it rotates around you while you lie on a table. A computer

then combines these pictures into images of slices of the part of your body being studied. Unlike a regular x-ray, a CT scan creates images of the soft tissues in the body.

After the first set of pictures is taken you may be asked to drink a contrast solution or receive an IV (intravenous) line through which a contrast dye is injected. This helps better outline structures in your body. A second set of pictures is then taken.

The contrast may cause some flushing (a feeling of warmth, especially in the face). Some people are allergic and get hives. Rarely, more serious reactions like trouble breathing or low blood pressure can occur. Be sure to tell the doctor if you have ever had a reaction to any contrast material used for x-rays.

In recent years, *spiral CT* (also known as helical CT) has become available in many medical centers. This type of CT scan uses a faster machine. The scanner part of the machine rotates around the body continuously, allowing doctors to collect the images much more quickly than standard CT. This lowers the chance of "blurred" images occurring as a result of breathing motion. It also lowers the dose of radiation received during the test. The biggest advantage may be that the "slices" it images are thinner, which yields more detailed pictures and allows doctors to look at suspicious areas from different angles

CT scans take longer than regular x-rays. You need to lie still on a table while they are 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.

The CT scan can help determine the location and size of thyroid cancers and whether they have spread to nearby areas, although ultrasound is usually the test of choice. A CT scan can also be used to look for spread into distant organs such as the lungs.

In some cases, a CT scan can be used to guide a biopsy needle precisely into a suspected area of cancer spread. For a CT-guided needle biopsy, you remain on the CT scanning table, while a radiologist advances a biopsy needle toward the location of the mass. CT scans are repeated until the doctors can see that the needle is within the mass. A biopsy sample is then removed and looked at under a microscope.

One disadvantage of CT scans for differentiated thyroid cancer is that the CT contrast dye contains iodine, which interferes with radioiodine scans. For this reason, many doctors prefer MRI scans instead of CT scans.

### **Magnetic resonance imaging**

Like CT scans, magnetic resonance imaging (MRI) scans can be used to look for cancer in the thyroid or cancer that has spread to nearby or distant parts of the body, although ultrasound is usually the first choice for looking at the thyroid. MRI can provide very

detailed images of soft tissues such as the thyroid gland. MRI scans are also particularly helpful in looking at the brain and spinal cord.

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 body tissue and by certain diseases. A computer translates the pattern into a very detailed image of parts of the body. A contrast material called gadolinium is often injected into a vein before the scan to better see details.

MRI scans are a little more uncomfortable than CT scans. First, they take longer -- often up to an hour. Second, you have to lie inside a narrow tube, which is confining and can upset people with claustrophobia (a fear of enclosed spaces). Newer, "open" MRI machines can sometimes help with this if needed. The machine also makes buzzing and clicking noises that you may find disturbing. Some centers provide headphones with music to block this noise out.

### **Nuclear medicine scans**

Nuclear medicine (radionuclide) scans involve putting substances with small amounts of radiation into the body and then detecting where the substances go with special cameras. These tests can help locate cells in the body that are not behaving normally, although they don't provide very detailed images.

**Radioiodine scan:** For this test, a small amount of radioactive iodine is swallowed (usually as a pill) or injected into a vein. Radioactive iodine is also used to treat differentiated thyroid cancer (papillary, follicular, and Hurthle cell), but in much higher doses. The iodine is absorbed by the thyroid gland (or thyroid cells anywhere in the body) over time, and a special camera is used several hours later to see where the radioactivity has gone.

For a thyroid scan, the camera is placed in front of your neck to measure the amount of radiation in the gland. Abnormal areas of the thyroid that contain less radioactivity than the surrounding tissue are called *cold nodules*, and areas that take up more radiation are called *hot nodules*. Hot nodules usually are not cancerous, but cold nodules can be either benign or cancerous. Because both benign and cancerous nodules can appear cold, this test by itself can't diagnose thyroid cancer.

Radioiodine scans are frequently used in the care and management of patients with differentiated thyroid cancer. Because medullary thyroid cancer cells do not take up iodine, radioiodine scans are not used for this cancer. If a biopsy has determined that a thyroid cancer is present, whole-body radioiodine scans are very useful to follow-up potential spread throughout the body from differentiated thyroid cancers. Scans after surgery can also help determine how far a thyroid cancer has spread, if at all.

If the entire thyroid gland has been removed because of cancer, radioiodine scans may be done frequently. The scan becomes more sensitive in this instance because more of the radioactive iodine is picked up by thyroid cancer cells that have spread elsewhere.

Radioiodine scans work best if patients have high blood levels of *thyroid-stimulating hormone (TSH, or thyrotropin)*. TSH levels may be increased by stopping thyroid hormone pills for a few days to a few weeks before the test. This lowers thyroid hormone levels and causes the pituitary gland to release more TSH, which in turn stimulates the cancer cells to take up the radioactive iodine. Although this intentional hypothyroidism is temporary, it can cause symptoms like tiredness, depression, weight gain, sleepiness, constipation, muscle aches, and reduced concentration. An injectable form of thyrotropin is now available that can increase patients' TSH levels before radioiodine scanning, so withholding thyroid hormone for a long period of time may not be necessary.

Because iodine that is already in the body can interfere with this test, people are usually told not to ingest foods or medicines that contain iodine in the days before the scan.

**Positron emission tomography:** Positron emission tomography (PET) scans are done after glucose (a form of sugar) that contains a radioactive atom is injected into the blood. Because cancer cells in the body are growing rapidly, they absorb large amounts of the radioactive sugar. A special camera can then create a picture of areas of radioactivity in the body.

This test can be very useful if your thyroid cancer is one that doesn't take up radioactive iodine. In this situation, the PET scan may be able to tell if the cancer has spread.

PET scans do not show anatomical details as clearly as a CT or MRI, but some newer machines are able to perform both a PET and CT scan at the same time (PET/CT scan). This lets the doctor see areas that "light up" on the PET scan in more detail.

**Octreotide scan:** Sometimes an octreotide scan, which uses a radioactively tagged hormone, may be done to look for the spread of medullary thyroid cancer. These cancers don't take up iodine, so radioiodine scans can't be used for them.

## Blood tests

No blood test can tell whether a thyroid nodule is cancerous. However, tests of blood levels of *thyroid-stimulating hormone (TSH)* may be used to check the overall activity of your thyroid gland. This information can be used to help choose imaging tests (ultrasound or nuclear scans) for the initial evaluation of a thyroid nodule. Levels of thyroid hormones (T3 and T4) may also be measured to get a sense of thyroid gland function.

Thyroglobulin is a protein made by the thyroid gland. Its measurement in the blood cannot be used to diagnose thyroid cancer. But after removing most of the thyroid by surgery and destroying the remaining normal cells with radioactive iodine (using the high doses for

treatment), levels of thyroglobulin in the blood should be very low. If they are not low, this might mean that thyroid cancer is still present. If the level rises, it is a sign that the cancer may be coming back.

If medullary thyroid carcinoma (MTC) is suspected or if you have a family history of the disease, blood tests for calcitonin levels can help tell if MTC might be present. This test is also useful to look for the possible recurrence after treatment of MTC. Because calcitonin can affect blood calcium levels, these may be checked as well. People with MTC often have high blood levels of a protein called carcinoembryonic antigen (CEA). Tests for CEA can sometimes help tell if cancer is present.

You may have other blood tests as well. For example, if you are scheduled for surgery, tests will be done to check your blood cell counts, to look for bleeding disorders, and to check the function of your liver and kidneys.

## How is thyroid cancer staged?

*Staging* is the process of finding out if and how far a cancer has spread. The stage of a cancer is one of the most important factors in choosing treatment options and predicting your chance for cure and long-term survival.

Staging is based on the results of the physical exam, biopsy, and imaging tests (ultrasound, CT scan, MRI, chest x-ray, and/or nuclear medicine scans), which are described in the section, "How is thyroid cancer diagnosed?"

## The TNM staging system

A staging system is a standard way for the cancer care team to summarize how large a cancer is and how far it has spread. Ask your doctor to explain thyroid cancer staging in a way that you understand so that you can take a more active role in making informed decisions about your treatment.

The most common system used to describe the stages of cancers is the American Joint Committee on Cancer (AJCC) *TNM* system. The *TNM* system describes 3 key pieces of information:

- **T** indicates the size of the main (primary) **tumor** and whether it has grown into nearby areas.
- **N** describes the extent of spread to nearby (regional) lymph **nodes**. Lymph nodes are small bean-shaped collections of immune system cells that are important in fighting

infections. Cells from thyroid cancers can travel to lymph nodes in the neck and chest areas.

- **M** indicates whether the cancer has spread (**metastasized**) to other organs of the body. (The most common site of spread of thyroid cancer is to the lungs. The next most common sites are the liver and bones.)

Numbers or letters appear after T, N, and M to provide more details about each of these factors. The numbers 0 through 4 indicate increasing severity. The letter X means "cannot be assessed because the information is not available."

### **T categories for thyroid cancer**

**TX:** Primary tumor cannot be assessed

**T0:** No evidence of primary tumor

**T1:** The tumor is 2 cm (slightly less than an inch) across or smaller and has not grown out of the thyroid.

**T1a:** The tumor is 1 cm (less than half an inch) across or smaller and has not grown outside the thyroid.

**T1b:** The tumor is larger than 1 cm but not larger than 2 cm across and has not grown outside of the thyroid.

**T2:** The tumor is between 2 cm and 4 cm (slightly less than 2 inches) across and has not grown out of the thyroid.

**T3:** The tumor is either larger than 4 cm or it has begun to grow a small amount into nearby tissues outside the thyroid.

**T4a:** A tumor of any size that has grown extensively beyond the thyroid gland into nearby tissues of the neck, such as the larynx (voice box), trachea (windpipe), esophagus (tube connecting the throat to the stomach), or the nerve to the larynx. This is also called *moderately advanced disease*.

**T4b:** A tumor of any size that has grown either back toward the spine or into nearby large blood vessels. This is also called *very advanced disease*.

### **T categories for anaplastic thyroid cancers:**

**T4a:** Tumor is still within the thyroid.

**T4b:** Tumor has grown outside of the thyroid.

## **N categories for thyroid cancer**

**NX:** Regional (nearby) lymph nodes cannot be assessed.

**N0:** No spread to nearby lymph nodes.

**N1:** The cancer has spread to nearby lymph nodes.

**N1a:** Spread to lymph nodes around the thyroid in the neck (called *pretracheal*, *paratracheal*, and *prelaryngeal* lymph nodes).

**N1b:** Spread to other lymph nodes in the neck (called *cervical*) or to lymph nodes behind the throat (*retropharyngeal*) or in the upper chest (*superior mediastinal*).

## **M categories for thyroid cancer**

**MX:** Presence of distant metastasis (spread) cannot be assessed.

**M0:** No distant metastasis.

**M1:** Distant metastasis is present, involving distant lymph nodes, internal organs, bones, etc.

## **Stage grouping**

Once the values for T, N, and M are determined, they are combined to find the stage. Stage is expressed as a Roman numeral I through IV, with letters used to divide a stage into substages. Unlike most other cancers, thyroid cancers are grouped into stages in a way that considers both the subtype of cancer and the patient's age.

### **Papillary or follicular thyroid carcinoma (differentiated thyroid cancer) in patients younger than 45**

Younger people have a low likelihood of dying from differentiated (papillary or follicular) thyroid cancer. The TNM stage groupings for these cancers take this fact into account. So, all people younger than 45 years with papillary thyroid cancer, for example, are *stage I* if they have no distant spread and *stage II* if they have distant metastases beyond the neck or upper mediastinal lymph nodes.

**Stage I (any T, any N, M0):** The tumor can be any size (any T) and may or may not have spread to nearby lymph nodes (any N). It has not spread to distant sites (M0).

**Stage II (any T, any N, M1):** The tumor can be any size (any T) and may or may not have spread to nearby lymph nodes (any N). It has spread to distant sites (M1).

**Papillary or follicular thyroid carcinoma (differentiated thyroid cancer) in patients 45 years and older:**

**Stage I (T1, N0, M0):** The tumor is 2 cm or less across and has not grown outside the thyroid (T1). It has not spread to nearby lymph nodes (N0) or distant sites (M0).

**Stage II (T2, N0, M0):** The tumor is more than 2 cm but not larger than 4 cm across and has not grown outside the thyroid (T2). It has not spread to nearby lymph nodes (N0) or distant sites (M0).

**Stage III:** One of the following applies:

**T3, N0, M0:** The tumor is larger than 4 cm or has grown slightly outside the thyroid (T3), but it has not spread to nearby lymph nodes (N0) or distant sites (M0).

OR

**T1 to T3, N1a, M0:** The tumor is any size and may have grown slightly outside the thyroid (T1 to T3). It has spread to lymph nodes around the thyroid in the neck (N1a) but not to distant sites (M0).

**Stage IVA:** One of the following applies:

**T4a, any N, M0:** The tumor is any size and has grown beyond the thyroid gland and into nearby tissues of the neck. It may or may not have spread to nearby lymph nodes (any N). It has not spread to distant sites (M0).

OR

**T1 to T3, N1b, M0:** The tumor is any size and may have grown slightly outside the thyroid gland (T1 to T3). It has spread to certain lymph nodes in the neck (cervical nodes) or to lymph nodes in the upper chest (superior mediastinal nodes) or behind the throat (retropharyngeal nodes) (N1b) but not to distant sites (M0).

**Stage IVB (T4b, any N, M0):** The tumor is any size and has grown either back to the spine or into nearby large blood vessels (T4b). It may or may not have spread to nearby lymph nodes (any N), but it has not spread to distant sites (M0).

**Stage IVC (any T, any N, M1):** The tumor is any size and may or may not have grown outside the thyroid (any T). It may or may not have spread to nearby lymph nodes (any N). It has spread to distant sites (M1).

## **Medullary thyroid carcinoma**

**Stage I (T1, N0, M0):** The tumor is 2 cm or less across and has not grown outside the thyroid (T1). It has not spread to nearby lymph nodes (N0) or distant sites (M0).

**Stage II:** One of the following applies:

**T2, N0, M0:** The tumor is more than 2cm but not larger than 4 cm across and has not grown outside the thyroid (T2). It has not spread to nearby lymph nodes (N0) or distant sites (M0).

OR

**T3, N0, M0:** The tumor is larger than 4 cm or has grown slightly outside the thyroid (T3), but it has not spread to nearby lymph nodes (N0) or distant sites (M0).

**Stage III (T1 to T3, N1a, M0):** The tumor is any size and may have grown slightly outside the thyroid (T1 to T3). It has spread to lymph nodes around the thyroid in the neck (N1a) but not to distant sites (M0).

**Stage IVA:** One of the following applies:

**T4a, any N, M0:** The tumor is any size and has grown beyond the thyroid gland and into nearby tissues of the neck (T4a). It may or may not have spread to nearby lymph nodes (any N). It has not spread to distant sites (M0).

OR

**T1 to T3, N1b, M0:** The tumor is any size and may have grown slightly outside the thyroid gland (T1 to T3). It has spread to certain lymph nodes in the neck (cervical nodes) or to lymph nodes in the upper chest (superior mediastinal nodes) or behind the throat (retropharyngeal nodes) (N1b) but not to distant sites (M0).

**Stage IVB (T4b, any N, M0):** The tumor is any size and has grown either back towards the spine or into nearby large blood vessels (T4b). It may or may not have spread to nearby lymph nodes (any N), but it has not spread to distant sites (M0).

**Stage IVC (any T, any N, M1):** The tumor is any size and may or may not have grown outside the thyroid (any T). It may or may not have spread to nearby lymph nodes (any N). It has spread to distant sites (M1).

## **Anaplastic/undifferentiated thyroid carcinoma**

All anaplastic thyroid cancers are considered stage IV, reflecting the poor prognosis of this type of cancer.

**Stage IVA (T4a, any N, M0):** The tumor is still within the thyroid and may be resectable (removable by surgery). It may or may not have spread to nearby lymph nodes (any N), but it has not spread to distant sites (M0).

**Stage IVB (T4b, any N, M0):** The tumor has grown outside the thyroid and is not resectable. It may or may not have spread to nearby lymph nodes (any N), but it has not spread to distant sites (M0).

**Stage IVC (any T, any N, M1):** The tumor is any size and may or may not have grown outside of the thyroid (any T). It may or may not have spread to nearby lymph nodes (any N). It has spread to distant sites (M1).

## Recurrent (relapsed) cancer

This is not an actual stage in the TNM system. Recurrent (relapsed) disease means that the cancer has come back (recurred) after treatment. Thyroid cancer usually returns in the neck, but it may reappear in another part of the body (for example, lymph nodes, lungs, or bones). Doctors may assign a new stage based on how far the cancer has spread, but this is not usually as formal a process as the original staging. The presence of recurrent disease does not change the original, formal staging.

If you have any questions about the stage of your cancer or how it affects your treatment, do not hesitate to ask your doctor.

## Thyroid cancer survival by type and stage

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. Whether or not you want to read about the survival statistics below for thyroid cancer is up to you.

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 more accurate way to describe the prognosis for patients with a particular type and stage of cancer.

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 thyroid 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 [how well the cancer responds to treatment, etc.]. 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 following survival statistics come from the AJCC Cancer Staging Manual (7th ed).

### **Papillary thyroid cancer\***

<b>Stage</b>	<b>5-Year Relative Survival Rate</b>
I	100%
II	100%
III	93%
IV	51%

\*based on patients diagnosed 1998 to 1999

### **Follicular thyroid cancer\***

<b>Stage</b>	<b>5-Year Relative Survival Rate</b>
I	100%
II	100%
III	71%
IV	50%

\*based on patients diagnosed 1998 to 1999

*Note: All the stage III and IV patients with follicular or papillary thyroid cancer are, by definition, over 45 years old.*

### **Medullary thyroid cancer\*\***

<b>Stage</b>	<b>5-Year Relative Survival Rate</b>
I	100%
II	98%
III	81%
IV	28%

\*\*based on patients diagnosed between 1985 and 1991

## **Anaplastic**

The 5-year relative survival rate for anaplastic (undifferentiated) carcinomas, all of which are considered stage IV, is around 7% (based on patients diagnosed between 1985 and 1991).

## **How is thyroid 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.*

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

## **Making treatment decisions**

After thyroid cancer is found, your doctor will discuss treatment options with you. It is important to take the time to consider each of them. In choosing a treatment plan, factors to consider include the type and stage of the cancer and your general health.

The methods of treatment for thyroid cancer include surgery, radioactive iodine treatment, thyroid hormone therapy, external beam radiation therapy, and chemotherapy. The best approach often uses 2 or more of these methods, and most patients are cured of their thyroid cancer in this way.

If a cure is not possible, the goal may be to remove or destroy as much of the cancer as possible and to prevent the tumor from growing, spreading, or returning for as long as possible. Sometimes treatment is aimed at palliation (relieving symptoms, such as pain or problems with breathing and swallowing).

If you have any concerns about your treatment plan, sometimes it is a good idea to get a second opinion. In fact, many doctors encourage this. Some insurance companies even require a second opinion before they will agree to pay for certain treatments. A second opinion can provide more information and help you feel confident about the treatment plan you choose.

## **Surgery**

Surgery is the main treatment for thyroid cancer and is used in nearly every case, except perhaps some anaplastic thyroid cancers. If the results of fine needle aspiration (FNA) tests indicate thyroid cancer, surgery to remove the tumor and all or part of the remaining thyroid gland is usually recommended.

### **Lobectomy**

This operation is sometimes used for differentiated thyroid cancers that are small and that show no signs of spread beyond the thyroid gland. The lobe containing the cancer is removed, usually along with the isthmus (the small piece of the gland that acts as a "bridge" between the left and right lobes). Because this surgery leaves part of the gland behind, the patient may not require the lifelong use of thyroid hormone supplements afterward. But having some thyroid left can interfere with some tests to look for cancer recurrence after treatment, such as radioiodine scans and blood tests such as thyroglobulin.

### **Thyroidectomy**

This operation removes all (total thyroidectomy), nearly all (near-total thyroidectomy) or most (subtotal thyroidectomy) of the thyroid gland. It is the most common surgery for thyroid cancer. After a total thyroidectomy and radioablation, your doctor can most often follow you (continue to watch you for disease recurrence) with radioiodine scans and blood tests, e.g., thyroglobulin.

### **Lymph node removal**

When cancer has spread outside the thyroid gland, surgery is always used to remove as much cancer that has invaded the neck as possible, including cancer that has spread to lymph nodes. This is especially true for treatment of medullary thyroid cancer and for anaplastic cancer (when surgery is an option).

For papillary or follicular cancer where only 1 or 2 enlarged lymph nodes are thought to contain cancer, these enlarged nodes may be removed and any small deposits of cancer cells that are left are treated with radioactive iodine (see below). More often, several lymph nodes near the thyroid are removed in an operation called a *central compartment neck dissection*. Removal of more lymph nodes, including those on the side of the neck, is called a *modified radical neck dissection*.

### **Risks and side effects of surgery**

Patients who have thyroid surgery are often ready to leave the hospital within a few days after the operation. Potential complications of thyroid surgery include:

- temporary or permanent hoarseness or loss of voice (this can happen if the larynx (voice box) or windpipe is irritated by the breathing tube that was used during surgery or if the nerves to the larynx are damaged during surgery)
- damage to the parathyroid glands (small glands near the thyroid that help regulate blood calcium levels), which can lead to low blood calcium levels, causing muscle spasms and numbness and tingling sensations
- excessive bleeding or formation of a major blood clot in the neck ("hematoma")
- wound infection

Complications are less likely to happen when you have an experienced thyroid surgeon, especially one with specialized training. Most doctors recommend that the operation be done by a surgeon experienced in treating thyroid cancer.

If most or all of your thyroid gland is removed, you will need to take daily thyroid hormone replacement pills. All patients who have had near-total or total thyroidectomy will need this.

## **Radioactive iodine (radioiodine) therapy**

Your thyroid gland absorbs nearly all of the iodine in your blood. When a form of radioactive iodine (RAI) known as I-131 is taken into the body, it can destroy the thyroid gland and any other thyroid cells (including cancer cells) that take up iodine, without affecting the rest of your body. (The radiation dose used here is much stronger than the one used in radioiodine scans, which were described in "How is thyroid cancer diagnosed?") The radioactive iodine is usually given as a capsule or liquid.

This treatment can be used to destroy (ablate) any thyroid tissue not removed by surgery or to treat thyroid cancer that has spread to lymph nodes and other parts of the body.

Radioactive iodine therapy has been shown to improve the survival rate of patients with papillary or follicular thyroid cancer (differentiated thyroid cancer) that has spread to the neck or other body parts, and this treatment is now standard practice in such cases. But the benefits of RAI therapy are less clear for patients with small cancers of the thyroid gland that have not spread. Discuss the risks and benefits of RAI therapy in your particular case with your doctor. Radioactive iodine therapy is not used to treat anaplastic (undifferentiated) and medullary thyroid carcinomas because these types of cancer do not take up iodine.

For RAI therapy to be most effective, patients must have high levels of *thyroid-stimulating hormone* (TSH, or thyrotropin) in the blood. This substance stimulates thyroid tissue (and cancer cells) to take up radioactive iodine. After surgery, TSH levels can be raised by stopping thyroid hormone pills for several weeks. This causes very low thyroid hormone levels (a condition known as hypothyroidism), which in turn causes the pituitary gland to release more TSH. Although this intentional hypothyroidism is temporary, it can cause symptoms like tiredness, depression, weight gain, sleepiness, constipation, muscle aches, and reduced concentration. An injectable form of thyrotropin is now available that can increase a patient's TSH. It is sometimes used before thyroid scans, but it's not clear if it's as effective for RAI therapy as stopping thyroid hormones.

### **Risks and side effects**

Depending on the dose of radioiodine used and where you are being treated, you may need to be in the hospital for up to a few days after treatment, staying in a special isolation room to prevent others from being exposed to radiation. Some people may not need to be hospitalized. You may be allowed to go home after treatment. If this is the case, you will be given instructions on how to protect others from radiation exposure.

Short-term side effects of RAI treatment may include:

- neck tenderness
- nausea and upset stomach
- swelling and tenderness of the salivary glands
- dry mouth
- taste changes
- pain (this is rare)

Chewing gum or sucking on hard candy may help with salivary gland problems. Radioiodine treatment also reduces tear formation in some people, leading to dry eyes. If you wear contact lenses ask your doctor how long you should keep them out.

Men who receive large total doses because of many treatments with RAI may have lower sperm counts or, rarely, become infertile. Radioactive iodine may also affect a woman's ovaries, and some women may have irregular periods for up to a year after treatment. Many doctors recommend that women avoid becoming pregnant for 6 months to a year after treatment. No ill effects have been noted in children whose parents received radioactive iodine in the past.

Both men and women who have had RAI therapy may have a slightly increased risk of developing leukemia in the future. Doctors disagree on exactly how much this risk is increased, but most of the largest studies have found that this is an extremely rare complication. Some research even suggests the risk of leukemia may not be significantly increased. Again, discuss your individual risks and benefits with your doctor.

## Thyroid hormone therapy

Taking daily pills of thyroid hormone (thyroid hormone therapy) can serve 2 purposes:

- to help maintain the body's normal metabolism (by replacing missing thyroid hormone)
- to help stop cancer cells from growing (by lowering TSH levels)

After a thyroidectomy, the body is no longer able to make the thyroid hormone it needs, so patients must take thyroid hormone pills to replace the loss of the natural hormone.

Thyroid hormone may also help prevent some thyroid cancers from returning. Normal thyroid function is regulated by the pituitary gland. The pituitary makes a hormone called TSH that causes the thyroid gland to make thyroid hormone for the body. TSH also promotes growth of the thyroid gland and probably of thyroid cancer cells. The level of TSH, in turn, is regulated by how much thyroid hormone is in the blood. If the level of thyroid hormone is low, the pituitary makes more TSH. If the level of thyroid hormone is high, not as much TSH is needed, so the pituitary makes less of it.

Doctors have learned that by giving higher than normal doses of thyroid hormone, TSH levels can be kept very low. This may slow the growth of cancer cells and lower the chance of having some thyroid cancers (especially the high-risk cancers) come back.

### Possible side effects

Even though these higher than normal levels of thyroid hormone seem to have few side effects, some doctors have expressed concerns about long-term issues, such as possible effects on the bones and heart. Because of this, high doses of thyroid hormone may be reserved for people with differentiated thyroid cancers who are at high risk of recurrence.

## External beam radiation therapy

External beam radiation therapy uses high-energy rays (or particles) to destroy cancer cells or slow their rate of growth. A carefully focused beam of radiation is delivered from a machine outside the body. Generally, this type of radiation treatment is not used for cancers that take up iodine (that is, most differentiated thyroid cancers), which can be more effectively treated with radioiodine therapy. It is more often used as part of the treatment for medullary thyroid cancer and anaplastic thyroid cancer.

When a cancer that does not take up iodine has spread beyond the thyroid capsule, external radiation treatment may help treat the cancer or reduce the chance of the disease coming back in the neck after surgery. If a cancer does not respond to radioiodine therapy, external radiation therapy may be used to treat local neck recurrence or distant metastases that are causing pain or other symptoms.

External beam radiation therapy usually involves treatments 5 days a week for about 6 weeks. The treatment itself is painless and much like getting a regular x-ray. Each treatment lasts only a few minutes, although the setup time -- getting you into place for treatment -- usually takes longer.

### **Possible side effects**

The main drawback of this treatment is that the radiation can destroy nearby healthy tissue along with the cancer cells. Some patients get skin changes similar to a sunburn, but this slowly fades away. Trouble swallowing, hoarseness, and fatigue are also potential side effects of external beam radiation therapy.

To reduce the risk of side effects, doctors carefully figure out the exact dose needed and aim the beam as accurately as they can to hit the target.

For more information about radiation therapy, see the American Cancer Society document, *Understanding Radiation Therapy: A Guide for Patients and Families*.

## **Chemotherapy**

Chemotherapy uses anti-cancer drugs that are injected into a vein, injected into a muscle, or taken by mouth. Chemotherapy is systemic therapy, which means that the drug enters the bloodstream and circulates throughout the body (through the whole system) to reach and destroy the cancer cells.

Chemotherapy is seldom helpful for most types of thyroid cancer. It is combined with external beam radiation therapy for anaplastic thyroid cancer and is sometimes used for other advanced cancers that are no longer responding to other treatments.

### **Possible side effects**

Chemotherapy 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 chemotherapy, which can lead to side effects.

The side effects of chemotherapy depend on the type and dose of drugs given and the length of time they are taken. Specific chemotherapy agents may have other specific side effects that require monitoring. For example, doxorubicin the most common chemotherapy used in thyroid cancer, can decrease heart function. Therefore a patient taking doxorubicin will have follow-up exams that include regular heart function tests like echocardiograms. Some general 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)

These side effects are usually short-term and go away after treatment is finished. There are often ways to lessen these side effects. For example, drugs can be given to help prevent or reduce nausea and vomiting.

For more information about chemotherapy, see the American Cancer Society document, *Understanding Chemotherapy: A Guide for Patients and Families*.

## **Clinical trials**

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 <http://clinicaltrials.cancer.org>. 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](http://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-ACS-2345) and have it sent to you.

## Complementary and alternative therapies

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 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-ACS-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 of thyroid cancer by stage**

The type of treatment your doctor will recommend depends on the type and stage of the cancer and on your overall health. This section summarizes options usually considered for each type and stage of thyroid cancer.

### **Papillary carcinoma and papillary carcinoma variants**

**Stage I:** Lobectomy (removal of only the affected side of the thyroid gland) And Thyroidectomy are the two types of surgery to treat these cancers. Of the two, total thyroidectomy is most commonly performed. Radioiodine treatment is sometimes used after thyroidectomy, but the cure rate with surgery alone is excellent. In the unlikely event of recurrence, radioiodine treatment can still be offered.

If radioactive iodine treatment is planned, the start of thyroid hormone therapy may be delayed until the treatment is finished (usually about 6 weeks after surgery).

Some doctors recommend central compartment neck dissection (surgical removal of lymph nodes next to the thyroid). Although this operation has not been shown to improve cancer survival, it lowers the risk of cancer coming back in the neck area (local recurrence). It also makes it easier to accurately stage the cancer.

**Stages II to IV:** Most patients have a near-total thyroidectomy or total thyroidectomy with removal and microscopic examination of nearby lymph nodes. Some doctors recommend central compartment neck dissection (surgical removal of lymph nodes next to the thyroid). Although this has not been shown to improve survival, it lowers the risk of local recurrence (cancer coming back in the neck area). It also makes it easier to accurately stage the cancer. If cancer has spread to other neck lymph nodes, a modified radical neck dissection (a more extensive surgical removal of lymph nodes from the neck) is often done.

Radioactive iodine therapy is often used to destroy any remaining thyroid tissue after surgery and to treat any undetectable cancer remaining in the neck or elsewhere in the body that takes up iodine. External radiation may be used for cancers that do not take up iodine. Thyroid hormone therapy is used as well.

**Recurrent cancer:** Treatment of cancer that comes back after initial therapy depends mainly on where the cancer is, although other factors may be important as well. If the cancer recurrence can be located and appears to be resectable (removable), surgery is often used. If the cancer shows up on a radioiodine scan (meaning the cells are taking up iodine), radioiodine therapy may be used, either alone or with surgery. If the cancer does not show up on the radioiodine scan but is found by other imaging tests such as magnetic resonance imaging or positron emission tomography scan, external radiation may be used. Chemotherapy may be tried if the cancer has spread to several places and radioiodine is not helpful, although doctors are still trying to find effective drugs for this disease. Another option is taking part in a clinical trial of newer treatments.

### **Follicular and Hürthle cell carcinoma**

**Stages I to IV:** Most doctors recommend near-total or total thyroidectomy for these types of thyroid cancer. This surgery makes radioactive iodine treatment afterward more effective. As with papillary cancer, some lymph nodes usually are removed and examined. If cancer has spread to lymph nodes, a central compartment or modified radical neck dissection (surgical removal of lymph nodes from the neck) may be done. Because the thyroid is removed, patients will need thyroid hormone therapy as well.

Radioiodine scanning is usually done after surgery to look for areas still taking up iodine. Metastasis to nearby lymph nodes and to distant sites can be treated by radioactive iodine. For cancers that don't take up iodine, external beam radiation therapy may help treat the tumor or prevent it from growing back in the neck.

Distant metastases may need to be treated with external beam radiation therapy or chemotherapy if they do not respond to radioactive iodine.

**Recurrent cancer:** The options for treating cancer that comes back after initial treatment are basically the same as they are for recurrent papillary cancer (see above).

## **Medullary thyroid carcinoma**

Most doctors advise that patients diagnosed with medullary thyroid carcinoma (MTC) be tested for other tumors that are typically seen in patients with the MEN 2 syndromes (see "What are the risk factors for thyroid cancer?"), such as pheochromocytoma and parathyroid adenoma. Screening for pheochromocytoma is particularly important, since the unknown presence of this tumor can make anesthesia and surgery extremely dangerous. If they are forewarned, surgeons and anesthesiologists can medically pre-treat the patient to make surgery safe.

**Stages I and II:** Total thyroidectomy is the main treatment for MTC and often cures patients with stage I or stage II MTC. Regional lymph nodes are usually removed as well (central compartment or modified radical neck dissection). Thyroid hormone therapy is always given, since after total thyroidectomy the patient will not be able to make enough thyroid hormone to stay healthy. Although thyroid hormone therapy reduces the risk of papillary and follicular cancer recurrence, it does not reduce the likelihood of MTC recurrence.

Because MTC cells do not take up radioactive iodine, there is no role for radioactive iodine therapy in treating MTC. Still, some doctors advise giving a dose of radioactive iodine to destroy any remaining normal thyroid tissue. If MTC cells are in or near the thyroid, this may affect them as well.

**Stages III and IV:** Surgery is the same as for stages I and II (usually after screening for MEN 2 syndrome and pheochromocytoma). Thyroid hormone therapy is given afterward. When the tumor is extensive and invades many nearby tissues or cannot be completely removed, external beam radiation therapy may reduce the chance for recurrence in the neck.

**Recurrent cancer:** Surgery, external radiation therapy, or chemotherapy may be needed to treat recurrent disease in the neck or elsewhere. Clinical trials of new treatments may be another option if standard treatments aren't effective.

**Genetic testing in medullary thyroid cancer:** If you are told that you have MTC, even if you are the first one in the family to be diagnosed with this disease, ask your doctor about genetic counseling and testing. Genetic testing can find mutations in the RET gene -- seen in cases of familial MTC and the MEN 2 syndromes. If you have one of these mutations, it's important that family members (children, brothers, and sisters) be tested as well. Because almost all children and adults with positive genetic test results will develop MTC at some time, doctors generally agree that thyroidectomy to prevent MTC should be done soon after positive testing, even in children. Some would say especially in children, since some hereditary forms of MTC affect children and pre-teens. Total thyroidectomy can indeed prevent this cancer in carriers who have not yet developed it. Of course, this means that lifelong thyroid hormone replacement will be needed.

## **Anaplastic carcinoma**

**Stage IV (note: all anaplastic thyroid cancers are classified as stage IV):** Surgery may or may not be used to treat this cancer, because it is often widespread at the time of diagnosis. If the cancer is confined to the local area around the thyroid, which is rare, total thyroidectomy may be done. The goal of surgery is to remove as much cancer as possible in the neck area, ideally leaving no cancer tissue behind. Because of the way anaplastic carcinoma spreads, this is often difficult or impossible. Local spread to essential structures within the neck (the windpipe, arteries, etc.) is responsible for most deaths from this type of thyroid cancer.

External beam radiation therapy, alone or combined with chemotherapy, may be used:

- to treat the disease before surgery in order to increase the chance of complete tumor removal
- after surgery to try to control any disease that remains in the neck
- in cases where the tumor is too large or widespread to be treated by surgery

If the cancer is causing (or may eventually cause) trouble breathing, a hole (tracheostomy) may be placed surgically in the front of the neck to bypass the tumor and allow the patient to breathe more comfortably.

For cancers that have spread to distant sites, chemotherapy may be used, sometimes along with radiation therapy if the cancer is not too widespread. Clinical trials of newer treatments are an option as well.

## **More treatment information**

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](http://www.nccn.org)).

The NCI provides treatment information via telephone (1-800-4-CANCER) and its Web site ([www.cancer.gov](http://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](http://www.cancer.gov).

## **What should you ask your doctor about thyroid cancer?**

As you deal with your thyroid 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 question that is on your mind, no matter how minor it might seem. Among the questions you might want to ask are:

- What kind of thyroid cancer do I have?
- Are there tests that need to be done before treatment?
- Has my cancer spread beyond the thyroid gland?
- What is the stage of my thyroid cancer? What does this mean in my case?
- Is this form of thyroid cancer hereditary? Should my family be tested?
- How much surgery do I need? Should I get other treatments as well?
- What should I do to be ready for treatment?
- Will I need to take thyroid hormone for the rest of my life?
- How many thyroid operations a year do you perform?
- How do you feel about sentinel lymph node biopsy in my case?
- What other treatment choices do I have?
- Are there any clinical trials I should think about?
- What side effects can I expect from my treatments?
- What are the other risks of treatments?
- How long will it take me to recover from treatment?
- When can I go back to work after treatment?
- How soon after treatment can I have sex?
- Will this treatment affect my ability to have children? Do I need to avoid pregnancy for a while?
- What type of follow-up will I need after treatment?
- What are the chances that my cancer will recur?
- Should I get a second opinion?
- Based on what you've learned about my cancer, what are my chances of cure?

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

## **What happens after treatment for thyroid cancer?**

Completing treatment can be both stressful and exciting. You will be relieved to finish treatment, yet it is hard not to worry about cancer coming back. (When cancer returns, it is called recurrence.) This is a very common concern among those who have had cancer.

It may take a while before your confidence in your own recovery begins to feel real and your fears are somewhat relieved. Even with no recurrences, people who have had cancer learn to live with uncertainty.

## Follow-up care

After your treatment is over, it is very important to keep all follow-up appointments. During these visits, your doctors will ask about symptoms, examine you, and may order blood tests or imaging studies such as radioiodine scans or computed tomography (CT) scans. Follow-up is needed to check for cancer recurrence or spread, as well as possible side effects of certain treatments. This is the time for you to ask your health care team any questions you need answered and to discuss any concerns you might have.

Because most people do very well after treatment, follow-up care can continue for a lifetime. This is very important since thyroid cancers grow slowly and can recur even 10 to 20 years after initial treatment. Your health care team will explain what tests you need and how often they should be done.

If you have had a *papillary or follicular cancer*, and your thyroid gland has been completely removed and ablated, your doctors will do at least one radioactive iodine scan after your initial treatment is complete. This is usually done about 6 to 12 months later. After that, if the result is negative, then you will generally not need further scans unless indicated by other studies or findings. Your blood will also be tested for *thyroglobulin*. This substance is made by thyroid tissue and, after total thyroid removal and ablation, should be absent from your blood. If thyroglobulin begins to appear, it may be a sign the cancer is coming back, and further testing will be done. This usually includes a radioactive iodine scan, and may include PET scans and other imaging studies. For those with a low-risk, small papillary cancer that was treated by removing only one lobe of the thyroid, a physical exam by your doctor, as well as a thyroid ultrasound and periodic chest x-ray is typical.

Treatment of recurrent cancer is described in the section, "How is thyroid cancer treated?"

If you had *medullary thyroid cancer* (MTC), your doctors will check your blood levels of *calcitonin* and *carcinoembryonic antigen* (CEA). If these begin to rise, imaging tests such as a CT or magnetic resonance imaging (MRI) scan will be done to look for any cancer that may be coming back. If the tests show recurrent cancer, treatment is as described in the section, "How is thyroid cancer treated?"

Each type of treatment for thyroid cancer has side effects that may last for a few months. Some, like the need for oral thyroid hormone, may be permanent. You may be able to hasten your recovery by being aware of the side effects before you start treatment. You might be able to take steps to reduce them and shorten the length of time they last. Don't hesitate to tell your cancer care team about any symptoms or side effects that bother you so they can help you manage them.

## Seeing a new doctor

At some point after your cancer diagnosis and treatment, you may find yourself in the office of a new doctor. Your original doctor may have moved or retired, or you may have moved or changed doctors for some reason. It is important that you be able to give your new doctor the exact details of your diagnosis and treatment. Make sure you have the following information handy:

- a copy of your pathology report from any biopsy or surgery
- if you had surgery, a copy of your operative report
- if you were hospitalized, a copy of the discharge summary that every doctor must prepare when patients are sent home from the hospital
- finally, since some drugs can have long-term side effects, a list of your drugs, drug doses, and when you took them

It is also important to keep your medical insurance. Even though no one wants to think of their cancer coming back, it is always a possibility. If it happens, the last thing you want is to have to worry about paying for treatment.

## Lifestyle changes to consider during and after treatment

Having cancer and dealing with treatment can be time-consuming and emotionally draining, but it can also 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 begin this process during cancer treatment.

### Make healthier choices

Think about your life before you learned you had cancer. Were there things you did that might have made you less healthy? Maybe you drank too much alcohol, or ate more than you needed, or smoked, or didn't exercise very often. Emotionally, maybe you kept your feelings bottled up, or maybe you let stressful situations go on too long.

Now is not the time to feel guilty or to blame yourself. However, you can start making changes today that can have positive effects for the rest of your life. Not only will you feel better but you will also be healthier. What better time than now to take advantage of the motivation you have as a result of going through a life-changing experience like having cancer?

You can start by working on those things that you feel most concerned about. 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's Quitline® tobacco cessation program at 1-800-227-2345.

## **Diet and nutrition**

Eating right can be a challenge for anyone, but it can get even tougher during and after cancer treatment. For instance, treatment often may change your sense of taste. Nausea can be a problem. You may lose your appetite for a while and lose weight when you don't want to. On the other hand, some people gain weight even without eating more. This can be frustrating, too.

If you are losing weight or have taste problems during treatment, do the best you can with eating and remember that these problems usually improve over time. You may want to ask your cancer team for a referral to a dietitian, an expert in nutrition who can give you ideas on how to fight some of the side effects of your treatment. You may also find it helps to eat small portions every 2 to 3 hours until you feel better and can go back to a more normal schedule.

One of the best things you can do after treatment is to put healthy eating habits into place. You will be surprised at the long-term benefits of some simple changes, like increasing the variety of healthy foods you eat. Try to eat 5 or more servings of vegetables and fruits each day. Choose whole grain foods instead of white flour and sugars. Try to limit meats that are high in fat. Cut back on processed meats like hot dogs, bologna, and bacon. Get rid of them altogether if you can. If you drink alcohol, limit yourself to 1 or 2 drinks a day at the most. And don't forget to get some type of regular exercise. The combination of a good diet and regular exercise will help you maintain a healthy weight and keep you feeling more energetic.

## **Rest, fatigue, work, and exercise**

Fatigue is a very common symptom in people being treated for cancer. This is often not an ordinary type of tiredness but a "bone-weary" exhaustion that doesn't get better with rest. For some, this fatigue lasts a long time after treatment, and can discourage them from physical activity.

However, exercise can actually help you reduce fatigue. Studies have shown that patients who follow an exercise program tailored to their personal needs feel physically and emotionally improved and can cope better.

If you are ill and need to be on bed rest during treatment, it is normal to expect your fitness, endurance, and muscle strength to decline some. Physical therapy can help you maintain strength and range of motion in your muscles, which can help fight fatigue and the sense of depression that sometimes comes with feeling so tired.

Any program of 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 3 times a week. If you haven't exercised in a few years but can still get around, you may want to think about taking short walks.

Talk with your health care team before starting, and get their opinion about your exercise plans. Then, try to get an exercise buddy so that 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, though, you will need to balance activity with rest. It is okay to rest when you need to. It is really hard for some people to allow themselves to do that when they are used to working all day or taking care of a household. (For more information about fatigue, please see the publication, *Fatigue in People with Cancer*.)

Exercise can improve your physical and emotional health.

- It improves your cardiovascular (heart and circulation) fitness.
- It strengthens your muscles.
- It reduces fatigue.
- It lowers anxiety and depression.
- It makes you feel generally happier.
- It helps you feel better about yourself.

And long term, we know that exercise plays a role in preventing some cancers. The American Cancer Society, in its guidelines on physical activity for cancer prevention, recommends that adults take part in at least 30 minutes of moderate to vigorous physical activity, above usual activities, on 5 or more days of the week; 45 to 60 minutes of intentional physical activity are preferable. Children and teens are encouraged to try for at least 60 minutes a day of moderate to vigorous physical activity on at least 5 days a week.

## **How about your emotional health?**

Once your treatment ends, you may find yourself overwhelmed by 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 your treatment.

Now you may find that you think about the potential of your own death, or the effect of your cancer on your family, friends, and career. You may also begin to re-evaluate your relationship with your spouse or partner. Unexpected issues may also cause concern -- for instance, as you become healthier and have fewer doctor visits, you will see your health care team less often. That can be a source of anxiety for some.

This is an ideal time to seek out emotional and social 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 individual counselors.

Almost everyone who has been through cancer can benefit from getting some type of support. 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 realistic to go it all by yourself. And your friends and family may feel shut out if you decide not to 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 an appropriate group or resource.

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 healthy choices and feeling as well as possible, physically and emotionally.

## **What happens if treatment is no longer working?**

If cancer continues to grow after one kind of treatment, or if it returns, it is often possible to try another treatment plan that might still cure the cancer, or at least shrink the tumors enough to help you live longer and feel better. On the other hand, when a person has received several different medical treatments and the cancer has not been cured, over time the cancer tends to become resistant to all treatment. At this time it's important to weigh the possible limited benefit of a new treatment against the possible downsides, including continued doctor visits and treatment side effects.

Everyone has his or her own way of looking at this. Some people may want to focus on remaining comfortable during their limited time left.

This is likely to be the most difficult time in your battle with cancer -- when you have tried everything medically within reason and it's just not working anymore. Although your doctor may offer you new treatment, you need to consider that at some point, continuing treatment is not likely to improve your health or change your prognosis or survival.

If you want to continue treatment to fight your cancer as long as you can, you still need to consider the odds of more treatment having any benefit. In many cases, your doctor can estimate the response rate for the treatment you are considering. Some people are tempted to try more chemotherapy or radiation, for example, even when their doctors say that the odds

of benefit are less than 1%. In this situation, you need to think about and understand your reasons for choosing this plan.

No matter what you decide to do, it is important that you be as comfortable as possible. Make sure you are asking for and getting treatment for any symptoms you might have, such as pain. This type of treatment is called *palliative* treatment.

Palliative treatment helps relieve these symptoms, but is not expected to cure the disease; its main purpose is to improve your quality of life. Sometimes, the treatments you get to control your symptoms are similar to the treatments used to treat cancer. For example, radiation therapy might be given to help relieve bone pain from bone metastasis. Or chemotherapy might be given to help shrink a tumor and keep it from causing a bowel obstruction. But this is not the same as receiving treatment to try to cure the cancer.

At some point, you may benefit from hospice care. Most of the time, this can be given at home. Your cancer may be causing symptoms or problems that need attention, and hospice focuses on your comfort. You should know that receiving hospice care doesn't mean you can't have treatment for the problems caused by your cancer or other health conditions. It just means that the focus of your care is on living life as fully as possible and feeling as well as you can at this difficult stage of your cancer.

Remember also that maintaining hope is important. 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. In a way, pausing at this time in your cancer treatment is an opportunity to refocus on the most important things in your life. This 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.

## **What's new in thyroid cancer research and treatment?**

Important research into thyroid cancer is under way right now 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. In past years, for example, evidence has grown showing the benefits of combining surgery with radioactive iodine therapy and thyroid hormone therapy. The results include higher cure rates, lower recurrence rates, and longer survival.

### **Genetics**

Recent identification of the genetic causes of familial (inherited) medullary thyroid cancer now makes it possible to identify family members carrying the abnormal gene and to prevent cancer from developing. Researchers are optimistic that progress in understanding the

abnormal genes that cause sporadic (not inherited) thyroid cancer, especially papillary cancer, will eventually lead to better treatments.

## Treatment

New treatments for thyroid cancer are being tested in several types of clinical trials.

### Radioactive iodine

Research to better define who needs RAI therapy after surgery is ongoing. A promising approach was described in a presentation recently using blood tests for thyroglobulin after thyroid surgery. If the thyroglobulin was very low after 3 months, RAI was not given to some of these patients and after 3.2 years none of them have had a recurrence. However, these results are preliminary and more research is needed.

### Chemotherapy

Some studies are testing the value of newer chemotherapy drugs such as paclitaxel (Taxol) and other drugs, as well as combined chemotherapy and radiation in treating anaplastic thyroid cancer.

### Targeted therapies

In general, thyroid cancers have not been found to respond well to chemotherapy. But exciting data are emerging about some newer targeted drugs. Unlike standard chemotherapy drugs, which work by attacking rapidly growing cells in general (which includes cancer cells), these drugs attack specific targets on cancer cells. The targets they attack can be present on normal cells as well, but the goal is to find targets that help cancer cells grow and survive.

**Tyrosine kinase inhibitors:** A class of targeted drugs known as tyrosine kinase inhibitors has already been used successfully in some other forms of cancer. These drugs may help reverse the abnormal growth of thyroid cancer cells that results from mutations of certain genes, such as *BRAF* and *RET/PTC*. Many of them also have anti-angiogenic properties (see below) Some of the tyrosine kinase inhibitors being tested against thyroid cancer in clinical trials include sorafenib (Nexavar), sunitinib (Sutent), motesanib (AMG 706), axitinib (AG-013736), and vandetanib (Zactima). Several studies have been recently reported showing that these drugs can shrink many thyroid cancers. None will likely be a cure, but will cause some shrinkage in many thyroid cancers. These studies are promising, but they are not yet routine treatments for thyroid cancer. Studies combining these agents with other agents like chemotherapy will be done to try to increase the benefits.

**Anti-angiogenesis drugs:** As tumors grow, they need a larger blood supply to get enough nutrients. They do this by causing new blood vessels to form (a process called angiogenesis). Anti-angiogenesis drugs work by disrupting these new blood vessels. Some of the tyrosine kinase inhibitors listed above have anti-angiogenic properties. Another drug with these properties is combretastatin A-4 phosphate (CA4P), which has shown some promising early results and is now being tested in larger studies. Lenalidomide, a drug with anti-angiogenic effects used in some blood cancers, has shown some promising results in a recent, small study.

**Monoclonal antibodies:** Monoclonal antibodies are man-made versions of immune system proteins designed to attack a very specific target. Studies are testing radiolabeled monoclonal antibodies (antibodies with radioactive material attached) for treating medullary thyroid cancer (MTC). The antibodies help deliver the radiation to the cancer cell. Carcinoembryonic antigen (CEA) is a protein that is not normally found in adult tissues. But many MTCs make CEA. Since radioiodine treatment is not useful in MTC because MTC does not take up iodine, the ability to deliver radiation (and other treatments) to MTC cells by bonding radioactive material to anti-CEA antibodies appears promising. Studies of this technique are in progress.

## Additional resources

### More information from your American Cancer Society

The following related information 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)

Caring for the Person With Cancer at Home: A Guide for Patients and Families (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)

The following book is available from the American Cancer Society. Call us at 1-800-ACS-2345 to ask about costs or to place your order.

*Caregiving: A Step-By-Step Resource for Caring for the Person With Cancer at Home*

## National organizations and Web sites\*

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

### **American Association of Clinical Endocrinologists**

Telephone number:: 1-904-353-7878

Web site: [www.aace.com](http://www.aace.com)

### **American Thyroid Association**

Toll-free number: 1-800-THYROID (1-800-849-7643)

Web site: [www.thyroid.org](http://www.thyroid.org)

### **Endocrine Web**

Web site: [www.endocrineweb.com](http://www.endocrineweb.com)

### **National Cancer Institute**

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

Web site: [www.cancer.gov](http://www.cancer.gov)

### **ThyCa: Thyroid Cancer Survivor's Association**

Toll-free number: 1-877-588-7904

Web site: [www.thyca.org](http://www.thyca.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](http://www.cancer.org).

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