

Lung Cancer

What Is Cancer?

Cancer develops when cells in a part of the body begin to grow out of control. Although there are many kinds of cancer, they all start because of out-of-control growth of abnormal cells.

Normal body cells grow, divide, and die in an orderly fashion. During the early years of a person's life, normal cells divide more rapidly until the person becomes an adult. After that, cells in most parts of the body divide only to replace worn-out or dying cells and to repair injuries.

Because cancer cells continue to grow and divide, they are different from normal cells. Instead of dying, they outlive normal cells and continue to form new abnormal cells.

Cancer cells often travel to other parts of the body where they begin to grow and replace normal tissue. This process, called metastasis, occurs as the cancer cells get into the bloodstream or lymph vessels of our body. When cells from a cancer like breast cancer spread to another organ like the liver, the cancer is still called breast cancer, not liver cancer.

Cancer cells develop because of damage to DNA. This substance is in every cell and directs all its activities. Most of the time when DNA becomes damaged the body is able to repair it. In cancer cells, the damaged DNA is not repaired. People can inherit damaged DNA, which accounts for inherited cancers. Many times though, a person's DNA becomes damaged by exposure to something in the environment, like smoking. Scientists still do not understand what damages person's DNA becomes damaged and leads to cancer.

Cancer usually forms as a tumor. Some cancers, like leukemia, do not form tumors. Instead, these cancer cells involve the blood and blood-forming organs, and circulate through other tissues where they grow.

Remember that not all tumors are cancerous. Benign (noncancerous) tumors do not spread to other parts of the body (metastasize) and, with very rare exceptions, are not life-threatening.

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 cancer.

Cancer is the second leading cause of death in the United States. Half of all men and one-third of all women in the US will develop cancer during their lifetimes. Today, millions of people are living with cancer or have had cancer. The risk of developing most types of cancer can be reduced by changes in a person's lifestyle, for example, by quitting smoking and eating a better diet. The sooner a cancer is found and treatment begins, the better are the chances for living for many years.

What Is Lung Cancer?

The Lungs

Your lungs are two sponge-like organs found in your chest cavity. Your right lung is divided into 3 sections, called lobes. Your left lung has 2 lobes. It is smaller because your heart takes up more room on that side of the body. When you breath, air goes into your lung through the *trachea* (windpipe). The trachea divides into tubes called the *bronchi*, which divide into smaller branches called the *bronchioles*. At the end of the bronchioles are tiny air sacs known as *alveoli*. Many tiny blood vessels run through the alveoli, absorbing oxygen from the inhaled air into your bloodstream and releasing carbon dioxide. Taking in oxygen and getting rid of carbon dioxide are your lungs' main function. A lining, called the pleura surrounds the lungs. This lining protects your lungs and facilitates their sliding motion as they expand and contract during breathing.

Most lung cancers start in the lining of the bronchi. Less often, cancers begin in the trachea, bronchioles, or alveoli. Lung cancers are thought to develop over a period of many years. First, there may be areas of precancerous changes in the lung. These changes do not form a mass or tumor. They cannot be seen on an x-ray and they do not cause symptoms. But, these precancerous changes can be found by analyzing cells in the lining of the airways of smoke-damaged lungs. These precancerous changes often progress to true cancer. These cancer cells may produce chemicals that cause new blood vessels to form nearby. These new blood vessels nourish the cancer cells, which can continue to grow and form a tumor large enough to see on x-rays. Cells from the cancer can break away from the original tumor and spread to other parts of the body. This process is called *metastasis*. Lung cancer is a life-threatening disease because it often spreads in this way even before it can be detected on a chest x-ray.

Types of Lung Cancer

There are two major types of lung cancer:

- Small cell lung cancer (SCLC)
- Non-small cell lung cancer (NSCLC).

If a lung cancer has characteristics of both types it is called a *mixed small cell/large cell carcinoma*.

Small Cell Lung Cancer: About 20% of all lung cancers are small cell. SCLC is named for the size and appearance of the cancer cells. Although each of the cells is small, they can multiply quickly and form large tumors, and can spread to lymph nodes and other organs such as the bones, brain, adrenal glands, and liver. This type of cancer often starts in the bronchi and toward the center of the lungs. Small cell lung cancer is almost always caused by smoking. It is very rare for someone who has never smoked to have small cell lung cancer. Other names for SCLC are *oat cell carcinoma* and *small cell undifferentiated carcinoma*.

Non-small Cell Lung Cancer: The remaining 80% of lung cancers are non-small cell. There are three sub-types of NSCLC. The cells in these sub-types differ in size, shape, and chemical make-up.

- **Squamous Cell Carcinoma**: About 30% of all NSCLC are squamous cell carcinomas. It is associated with a history of smoking and tends to be found centrally, near a bronchus.
- **Adenocarcinoma**: This type accounts for about 40% of NSCLC. It is usually found in the outer region of lung. People with one type of adenocarcinoma, known as bronchioloalveolar carcinoma (sometimes called bronchioalveolar carcinoma or bronchoalveolar carcinoma), tend to have a better outlook (*prognosis*) than those with other types of lung cancer.

Large-Cell Undifferentiated Carcinoma: This type of cancer accounts for about 10% of lung cancers. It may appear in any part of the lung and it tends to grow and spread quickly resulting in a poor prognosis.

Other Types of Lung Cancer

In addition to the 2 main types of lung cancer, other tumors can occur in the lungs. Some of these are non-cancerous (*benign*). Carcinoid tumors of the lung account for less than 5% of lung tumors. Most are slow-growing tumors. They are generally cured by surgery. Although some carcinoid tumors can spread, they usually have a better prognosis than small cell or non-small cell lung cancer. For more information, about carcinoid tumors see the American Cancer Society document "Lung Carcinoid Tumors."

There are other, even more rare, lung tumors such as *adenoid cystic carcinomas*, *hamartomas*, *lymphomas*, and *sarcomas*. Since these tumors are treated differently from the more common lung cancers, they are not discussed in this document.

What Are the Key Statistics About Lung Cancer?

During 2001, there will be about 169,500 new cases of lung cancer (90,700 among men and 78,800 among women). Lung cancer will account for about 13.4% of all new cancers. The average age of people diagnosed with lung cancer is 60; it does not usually occur in people under the age of 40.

Lung cancer is the leading cause of cancer death among both men and women. There will be an estimated 157,400 deaths from lung cancer (90,100 among men and 67,300 among women) in 2001, accounting for 28% of all cancer deaths. More people die of lung cancer than of colon, breast, and prostate cancers combined.

- The 1-year survival rate (the number of people who live at least 1 year after their cancer is diagnosed) for lung cancer was 41% in 1996, the last year for which we have national data. This had not changed in 10 years.
- The 5-year survival rate for all stages of lung cancer combined was 14% in 1996. This has not changed over many years.
- For people whose cancer is found and treated early with surgery, before it has spread to lymph nodes or other organs, the average 5-year survival rate is about 42%. However, only 15% of people with lung cancer are diagnosed at this early, localized stage.

The 5-year survival rate refers to the percent of patients who live at least 5 years after their cancer is diagnosed. Many of these patients live much longer than 5 years after diagnosis, and 5-year rates are used to produce a standard way of discussing prognosis. 5-year *relative* survival rates exclude from the calculations patients dying of other diseases, and are considered to be a more accurate way to describe the prognosis for patients with a particular type and stage of cancer. Of course, 5-year rates are based on patients diagnosed and initially treated more than 5 years ago. Improvements in treatment often result in a more favorable outlook for recently diagnosed patients.

What Are the Risk Factors for Lung Cancer?

A risk factor is anything that increases your chance of getting a disease such as cancer. Different cancers have different risk factors. For example, unprotected exposure to strong sunlight is a risk factor for skin cancer. But having a risk factor, or even several, does not mean you will get the disease.

Tobacco smoking

Smoking is by far the most important risk factor. At the beginning of the 20th century, lung cancer was rare. The introduction of manufactured cigarettes, which made them readily available, changed this. More than 80% of lung cancers are thought to result from smoking. The longer you smoke and the more packs per day you smoke, the greater your risk. If you stop smoking before a cancer develops, your damaged lung tissue gradually starts to return to normal. Ten years after stopping smoking, your risk is reduced to one-third of what it would have been if you continued to smoke. Cigar smoking and pipe smoking are almost as likely to cause lung cancer as cigarette smoking. There is no evidence that smoking low tar cigarettes reduces the risk of lung cancer.

If you don't smoke, but breathe in the smoke of others (also called *second-hand smoke* or *environmental tobacco smoke*) you are also at increased risk for lung cancer. A nonsmoker who is married to a smoker has a 30% greater risk of developing lung cancer than the spouse of a nonsmoker. Workers who have been exposed to tobacco smoke in the workplace are also more likely to get lung cancer.

Asbestos

If you are an asbestos worker, you are about 7 times more likely to die of lung cancer. Exposure to asbestos fibers is an important risk factor for lung cancer. And if you are an asbestos worker who smokes, your lung cancer risk is 50 to 90 times greater than that of people in general. Both smokers and nonsmokers exposed to asbestos also have a greater risk of developing a type of cancer that starts from the *pleura* (the layer of cells that line the outer surface of the lung). This cancer is called *mesothelioma*. Because it is usually considered a tumor of the pleura and not a type of lung cancer, mesothelioma is discussed in the American Cancer Society document, "Malignant Mesothelioma."

In recent years, the government has nearly stopped using asbestos in commercial and industrial products. It is still present in many homes and commercial buildings but is not considered harmful as long as it is not released by deterioration, demolition, or renovation.

Radon

When uranium breaks down naturally, it produces radon, a radioactive gas, which cannot be seen, tasted, or smelled. Outdoors, there is so little radon that it is not dangerous. But indoors, radon can be more concentrated and become a possible risk for cancer. Recently, concerns have been raised about houses in some parts of the United States built over soil with natural uranium deposits that can create high indoor radon levels. Studies from these areas have found that the risk of lung cancer is increased by 50% if you have lived for many years in a radon-contaminated house. This is a very small increase though, when it is compared to the lung cancer risk from tobacco. State and local offices of the Environmental Protection Agency [[Link to www.epa.gov](http://www.epa.gov)] can give you the names of reliable companies that perform radon testing and renovation. High radon levels in some mines can increase the lung cancer risk for miners.

Cancer-causing Agents in the Workplace

Other *carcinogens* (cancer-causing agents) found in the workplace that can increase your lung cancer risk include:

- Radioactive ores such as uranium
- Chemicals such as arsenic, vinyl chloride, nickel chromates, coal products, mustard gas, and chloromethyl ethers
- Fuels such as gasoline
- Diesel exhaust

The government and industry have taken major steps in recent years to protect workers. But the dangers are still present and if you work around these agents, you should be very careful to avoid exposure.

Marijuana

Marijuana contains more tar than cigarettes. Marijuana is also inhaled very deeply and the smoke is held in the lungs for a long time. Marijuana is smoked all the way to the end where tar content is the highest. Many of the cancer-causing substances in tobacco are also found in marijuana. Because marijuana is an illegal substance, it is not possible to control whether it contains fungi, pesticides, and other additives. Medical reports suggest marijuana may cause cancers of the mouth and throat.

It has been hard to prove a connection between marijuana and lung cancer, because it is not easy to gather information about the use of illegal drugs. Also, many marijuana smokers also smoke cigarettes. This makes it difficult to know how much of the risk is from tobacco and how much is from marijuana.

Recurring inflammation

Tuberculosis and some types of pneumonia often leave scars on the lung. If you have this scarring, it can increase your risk of developing the *adenocarcinoma* type of lung cancer.

Talcum powder

Although the use of cosmetic talcum powder has not been found to increase your risk of lung cancer, some studies suggest talc miners and millers have a higher risk of lung cancer and other respiratory diseases because of their exposure to industrial grade talc. Talcum powder is made from talc, a mineral that in its natural form may contain asbestos. By law since 1973, all home-use talcum products (baby, body, and facial powders) have been asbestos-free.

Other mineral exposures

People with *silicosis and berylliosis* (lung diseases caused by breathing in certain minerals) also have an increased risk of lung cancer.

Personal and family history

If you have had lung cancer, you have a higher risk of developing another lung cancer. Brothers, sisters, and children of those who have had lung cancer may have a slightly higher risk of lung cancer themselves. However, it is difficult to say how much of this excess risk is due to inherited factors and how much is due to environmental tobacco smoke.

Diet

Some reports have indicated that a diet low in fruits and vegetables may increase the chances you may get cancer if you are exposed to tobacco smoke. Evidence is growing that a diet containing lots of flavonoids (found in apples and onions as well as other fruits and vegetables) may protect you against lung cancer.

Gender

Many doctors think women who smoke or are exposed to tobacco smoke, are more likely to have lung cancer than men. Several studies have shown that if you are a woman, your lung cells may have a genetic predisposition to develop cancer when they are exposed to tobacco smoke.

Air pollution

In some cities, air pollution may slightly increase the risk of lung cancer. This risk is far less than that caused by smoking.

Do We Know What Causes Lung Cancer?

Tobacco smoking is by far the leading cause of lung cancer. More than 80% of lung cancers are caused directly by smoking and some of the rest are caused by environmental exposure to

tobacco smoke. Other risk factors for lung cancer include a family or personal history of lung cancer and exposure to cancer-causing agents in the workplace or the environment.

Recently, scientists have begun to understand how these risk factors produce certain changes in the DNA of cells in the lungs, causing them to grow abnormally and form cancers. DNA is the genetic material that carries the instructions for nearly everything our cells do. We usually resemble our parents because they passed their DNA on to us. However, DNA affects more than our outward appearance. Some *genes* (parts of our DNA) contain instructions for controlling when cells grow and divide.

- Genes that promote cell division are called *oncogenes*.
- Genes that slow down cell division or cause cells to die at the appropriate time are called *tumor suppressor genes*.

It is known that cancers can be caused by DNA *mutations* (defects) that activate (turn on) oncogenes or inactivate (turn off) tumor suppressor genes. Some people inherit DNA mutations from their parents that greatly increase their risk for developing breast, ovarian, colorectal and several other cancers. However inherited oncogene or tumor suppressor gene mutations are not believed to cause very many lung cancers.

Oncogene and tumor suppressor gene mutations related to lung cancer usually develop during life rather than before birth as an inherited mutation. Every time a cell prepares to divide into two new cells, it must duplicate its DNA. This process is not perfect and copying errors occur. Fortunately, cells have repair enzymes that proofread the DNA, but, some errors may slip past. Some people may have faulty DNA repair mechanisms that make them especially vulnerable to cancer-causing chemicals and radiation. Acquired mutations in lung cells often result from exposure to cancer-causing chemicals in tobacco smoke. Acquired changes in genes, such as the p53 tumor suppressor gene and the *ras* oncogene, are thought to be important in the development of lung cancer. Changes in these and similar genes may also make some lung cancers likely to grow and invade more rapidly than others.

Although inherited mutations of oncogenes or tumor suppressor genes rarely cause lung cancers, some people seem to inherit a reduced ability to detoxify (break down) certain types of cancer-causing chemicals.

Others may inherit an increased tendency to activate carcinogens, making them even more dangerous. These people are more sensitive to the cancer-causing effects of tobacco smoke and certain industrial chemicals. Researchers are developing tests that may help identify such people, but these tests are not yet reliable enough for routine use. Therefore, doctors recommend that all people avoid tobacco smoke and hazardous industrial chemicals.

Can Lung Cancer Be Prevented?

The best way to prevent lung cancer is to not smoke and to avoid people who do. If you already smoke, you should quit. You should also avoid breathing in other people's smoke. Find out about cancer-causing chemicals that you may be exposed to at work and take appropriate protective measures. If you live in an area where natural uranium deposits in the soil release radon gas, consider testing radon levels in your home.

Nevertheless, some people who get lung cancer do not have any apparent risk factors. Although we know how to prevent more than 80% of lung cancers, at this time we don't know how to prevent all of them.

Can Lung Cancer Be Found Early?

Since symptoms of lung cancer often do not appear until the disease is in an advanced stage, only about 15% of the lung cancer cases are found in the early stages before the cancer has spread to nearby lymph nodes or elsewhere. The 5-year survival rate for people with lung cancer is about 50% if there is no evidence of cancer in lymph nodes. Unfortunately in many others, their cancer has already spread even if it has not been detected by current medical tests.

Many early lung cancers are diagnosed *incidentally*, meaning they are found as a result of tests for some other medical condition. For example, a diagnosis may be made by imaging tests (such as a chest x-ray or chest CT scan), *bronchoscopy* (viewing the inside of *bronchi* through a flexible lighted tube), or sputum cytology (microscopic examination of cells in coughed up phlegm) performed for other reasons in patients with heart disease, pneumonia, or other lung conditions.

Screening Tests for Lung Cancer

Screening is the use of tests or examinations to detect a disease in people without symptoms of that disease. For example, the Pap test is used for cervical cancer screening. Because lung cancer usually spreads beyond the lungs before causing any symptoms, an effective screening program for early detection of lung cancer could save many lives.

The use of chest x-rays and sputum cytology (checking phlegm under the microscope to find cancer cells) has been tested for several years. The studies, which have been recently updated, have concluded that these tests could not find many lung cancers early enough to improve a person's chance for a cure. For this reason, lung cancer screening is not a routine practice for the general public or even for people at increased risk, such as smokers.

Recently, a new x-ray technique called spiral or helical low dose CT scanning has been successful in detecting early lung cancers in smokers and former smokers. It has not been shown if this will actually save lives, and studies are in progress to answer this important question. There are also new tests to detect early lung cancers by recognizing changes in the DNA of bronchial cells, which might be useful. However, these tests are still not routinely used. For more information, read the section "What's New in Lung Cancer Research and Treatment?"

How Is Lung Cancer Diagnosed?

If there is a reason to suspect you may have lung cancer, your doctor will use one or more methods to find out if the disease is really present. In addition, a biopsy of the lung tissue will confirm the diagnosis of cancer and also give valuable information that will help in making treatment decisions. If these tests find lung cancer, additional tests will be done to find out how far the cancer has spread.

Common Signs and Symptoms of Lung Cancer

Although most lung cancers do not cause any symptoms until they have spread too far to be cured, symptoms do occur in some people with early lung cancer. If you go to your doctor when you first notice symptoms, your cancer might be diagnosed and treated while it is in a curable stage. Or, at the least, you could live longer with a better quality of life. The most common symptoms of lung cancer are:

- A cough that does not go away
- Chest pain, often aggravated by deep breathing
- Hoarseness
- Weight loss and loss of appetite
- Bloody or rust-colored sputum (spit or phlegm)
- Shortness of breath
- Recurring infections such as bronchitis and pneumonia
- New onset of wheezing

When lung cancer spreads to distant organs, it may cause:

- Bone pain
- Neurologic changes (such as weakness or numbness of a limb, dizziness)
- Jaundice (yellow coloring of the skin and eyes)
- Masses near the surface of the body, due to cancer spreading to the skin or to lymph nodes (collection of immune system cells) in the neck or above the collarbone.

If you have any of these problems, see your doctor right away. These symptoms could be the first warning of a lung cancer. Many of these symptoms can also result from other causes or from noncancerous diseases of the lungs, heart, and other organs. Seeing a doctor is the only way to find out.

Horner's Syndrome: Cancer of the upper part of the lungs may damage a nerve that passes from the upper chest into your neck. Doctors sometimes call these cancers Pancoast tumors. Their most common symptom is severe shoulder pain. Sometimes they also cause Horner's syndrome. Horner's syndrome is the medical name for the group of symptoms consisting of drooping or weakness of one eyelid, reduced or absent perspiration on the same side of your face and a smaller *pupil* (dark part in the center of the eye) on that side.

Paraneoplastic Syndromes: Some lung cancers may produce hormone-like or other substances that enter the bloodstream and cause problems with distant tissues and organs, even though the cancer has not spread to those tissues or organs. These problems are called paraneoplastic (Latin for "tumor-related") syndromes. Sometimes these syndromes may be the first symptoms of early lung cancer. Because the symptoms affect other organs, patients and their doctors may suspect at first that diseases other than lung cancer cause them.

Patients with small cell lung cancer and those with non-small cell lung cancer often have different paraneoplastic syndromes. The most common paraneoplastic syndromes associated with small cell lung cancer are:

- *SIADH* (*syndrome of inappropriate antidiuretic hormone*) causes salt levels of the blood to become very low. Symptoms of SIADH include fatigue, loss of appetite, muscle

weakness or cramps, nausea, vomiting, restlessness, and confusion. Without treatment, severe cases may lead to seizures and coma.

- Production of substances that cause blood clots to form. Most of these clots occur in the veins of the legs, but they may clog up important vessels and interrupt blood flow to the limbs, lungs, brain, or other internal organs.
- Unexplained loss of balance and unsteadiness in arm and leg movement (cerebellar degeneration).

The most common paraneoplastic syndromes caused by non-small cell lung cancer are:

- *Hypercalcemia* (high blood calcium levels), causing urinary frequency, constipation, weakness, dizziness, confusion, and other nervous system problems.
- Excess growth of certain bones, especially those in the finger tips. The medical term for this is hypertrophic osteoarthropathy.
- Production of substances that activate the clotting system, leading to blood clots.
- Excess breast growth in men. The medical term for this condition is gynecomastia.

Medical History and Physical Exam

Your doctor will take a *medical history* (health-related interview) to check for risk factors and symptoms. Your doctor will also examine you physically to look for signs of lung cancer and other health problems.

Imaging Tests

Imaging tests use x-rays, magnetic fields, or radioactive substances to create pictures of the inside of your body. Several imaging tests are used to find lung cancer and determine where it may have spread in the body.

Chest x-ray: This is the first test your doctor will order to look for any mass or spot on the lungs. It is a plain x-ray of your chest and can be done in any outpatient setting. If this is normal, you probably don't have lung cancer.

Computed tomography (CT): The CT scan is an x-ray procedure that produces detailed cross-sectional images of your body. Instead of taking one picture, as does a conventional x-ray, a CT scanner takes many pictures as it rotates around you. A computer then combines these pictures into an image of a slice of your body. The machine will take pictures of multiple slices of the part of your body that is being studied. Often after the first set of pictures is taken you will receive an intravenous injection of a "dye" or *radiocontrast agent* that helps better outline structures in your body. A second set of pictures is then taken.

CT scans take longer than regular x-rays and you will need to lie still on a table while they are being done. But just like other computerized devices, they are getting faster and your stay might be pleasantly short. Also, you might feel a bit confined by the ring-like equipment you lie within when the pictures are being taken.

The contrast "dye" is injected through an IV line. Some people are allergic to the dye and get hives, a flushed feeling, or rarely more serious reactions like trouble breathing and low blood

pressure. Be sure to tell your doctor if you have ever had a reaction to any contrast material used for x-rays.

You may also be asked to drink one to two pints of a contrast solution. This helps outline your intestine if your doctor is looking at organs in your abdomen to see if the lung cancer has spread.

The CT scan will provide precise information about the size, shape, and position of a tumor, and can help find enlarged lymph nodes that might contain cancer that has spread from the lung. CT scans are more sensitive than a routine chest x-ray in finding early lung cancers. This test is also used to detect masses in the adrenal glands, brain, and other internal organs that may be affected by the spread of lung cancer.

Magnetic resonance imaging (MRI): MRI scans use radio waves and strong magnets instead of x-rays. The energy from the radio waves is absorbed and then released in a pattern formed by the type of tissue and by certain diseases. A computer translates the pattern of radio waves given off by the tissues into a very detailed image of parts of the body. Not only does this produce cross sectional slices of the body like a CT scanner, it can also produce slices that are parallel with the length of your body. A contrast material might be injected just as with CT scans, but is used less often. MRI scans take longer – often up to an hour. Also, you have to be placed inside a tube-like piece of equipment, which is confining and can upset people with claustrophobia. The machine also makes a thumping noise that you may find annoying. Some places will provide headphones with music to block this out. MRI images are particularly useful in detecting lung cancer that has spread to the brain or spinal cord.

Positron emission tomography (PET): Positron emission tomography (PET) uses *glucose* (a form of sugar) that contains a radioactive atom. Cancer cells in the body absorb large amounts of the radioactive sugar and a special camera can detect the radioactivity. This is a very important test if you have early stage lung cancer. Your doctor will use this test to see if the cancer has spread to lymph nodes. It is also helpful in telling whether a shadow on your chest x-ray is cancer. PET scans are also useful when your doctor thinks the cancer has spread, but doesn't know where. PET scans can be used instead of several different x-rays because they scan your whole body.

Angiography: For this procedure, doctors insert a very thin tube into a blood vessel that goes to the area to be studied. Contrast dye is injected rapidly and a series of x-ray images is then taken. This can show surgeons the location of blood vessels next to a cancer, so that they can remove it without causing a lot of bleeding.

Bone scans: This test involves injecting a small amount of radioactive substance (usually *technetium diphosphonate*) into a vein. The amount of radioactivity used is very low and causes no long-term effects. This substance accumulates in areas of bone that may be abnormal because of cancer metastasis. However, other noncancerous bone diseases can also cause abnormal bone scan results. Bone scans are routinely done in patients with small cell lung cancer. Usually, they are only done in patients with non-small cell lung cancer when other test results or symptoms suggest that the cancer has spread to the bones.

Procedures that Sample Tissues and Cells

One or more of these tests will be used to confirm that a lung mass seen on imaging tests is a lung cancer, rather than a benign condition. These tests are also used to determine the exact type of lung cancer you may have and to help determine how far it may have spread.

Sputum cytology: A sample of phlegm (the best way is to get early morning samples from you 3 days in a row) is examined under a microscope to see if cancer cells are present.

Needle biopsy: A needle can be guided into the mass while your lungs are being viewed with fluoroscopy (fluoroscopy is like an x-ray, but the image is viewed on a screen rather than on film). CT scans can also be used to guide the placement of needles. Unlike fluoroscopy, CT doesn't provide a continuous picture so the needle is inserted in the direction of the mass, a CT image is taken, and the direction of the needle is adjusted based on the image. This process is repeated a few times until the CT image confirms that the needle is within the mass. A sample of the mass is removed and looked at under the microscope to see if cancer cells are present.

Bronchoscopy: You will need to be sedated for this examination. A fiberoptic flexible, lighted tube is passed through your mouth into the bronchi (the larger tubes which carry air to the lungs). This can help find some tumors or blockages in the lungs. At the same time, it can also be used to take biopsies (samples of tissue) or samples of lung secretions to be examined under a microscope for cancer cells.

Mediastinoscopy and mediastinotomy: For both of these procedures, you will receive general anesthesia (put to sleep). With mediastinoscopy a small cut is made in your neck and a hollow lighted tube is inserted behind the sternum (breast bone). Special instruments, operated through this tube, can be used to take a tissue sample from the *mediastinal lymph nodes* (along the windpipe and the major bronchial tube areas). Looking at the samples under a microscope can show if cancer cells are present. Mediastinotomy also removes samples of mediastinal lymph nodes while the patient is under general anesthesia. Unlike mediastinoscopy, this surgical procedure opens the chest cavity by cutting through the sternum (breastbone) or the ribs. It allows the surgeon to reach more lymph nodes than does a mediastinoscopy procedure.

Thoracentesis and thoracoscopy: These procedures are done to check whether a pleural effusion (accumulation of fluid around the lungs) is the result of cancer metastasis to the pleural membranes (the delicate membranes that cover the lungs), or because of a benign condition such as heart failure or an infection. For thoracentesis, a needle is placed between the ribs to drain the fluid, which is checked under a microscope to look for cancer cells. Chemical tests of the fluid are also sometimes useful in distinguishing a malignant pleural effusion from a benign one. Once a malignant pleural fluid has been diagnosed, thoracentesis may be repeated to remove more fluid. Fluid accumulation can prevent the lungs from filling with air, so thoracentesis can help improve the patient's breathing. Thoracoscopy is a procedure that views the space between the lungs and the chest wall using a thin, lighted tube connected to a video camera and monitor.

Bone marrow biopsy: A needle is used to remove a sample of bone about 1/16 inch across and 1 inch long (usually from the back of your hip bone) after the area has been numbed with local anesthesia. The sample is checked for cancer cells under the microscope.

Blood counts and blood chemistry: A *complete blood count* (CBC) determines whether your blood has the correct number of various cell types. For example, it can tell if you are anemic. This test will be repeated regularly if you are treated with chemotherapy, because these drugs

temporarily affect blood-forming cells of the bone marrow. The *blood chemistry tests* can spot abnormalities in some of your organs. If cancer has spread to the liver and bones, it may cause certain chemical abnormalities in the blood.

How Is Lung Cancer Staged?

Staging is the process of finding out how localized or widespread your cancer is. It describes how far the cancer has spread. Your treatment and *prognosis* (the outlook for chances of survival) depend, to a large extent, on the cancer's stage. The tests described above such as CT, MRI, scans, bone marrow biopsy, mediastinoscopy, and blood tests are used to stage the cancer.

Staging of Non-small Cell Lung Cancer

The system used to describe the growth and spread of non-small cell lung cancer (NSCLC) is the **TNM** staging system, also known as the American Joint Committee on Cancer (AJCC) system. T stands for **tumor** (its size and how far it has spread within the lung and to nearby organs), N stands for spread to lymph **nodes**, and M is for **metastasis** (spread to distant organs). In TNM staging, information about the tumor, lymph nodes, and metastasis is combined and a stage is assigned to specific TNM groupings. The grouped stages are described using the number 0 and Roman numerals from I to IV (1 to 4).

Non-small Cell Lung Cancer T Stages

Tis: Cancer is found only in the layer of cells lining the air passages. It has not invaded other lung tissues. This stage is also known as *carcinoma in situ*.

T1: The cancer is no larger than 3 centimeters (slightly less than 1¼ inches), has not spread to the *visceral pleura* (membranes that surround the lungs), and does not affect the main branches of the bronchi.

T2: The cancer has one or more of the following features:

- It is larger than 3 cm
- It involves a main bronchus, but is not closer than 2 cm (about ¾ inch) to the point where the trachea (windpipe) branches into the left and right main bronchi
- It has spread to the *visceral pleura*
- The cancer may partially clog the airways, but this has not caused the entire lung to collapse or develop pneumonia

T3: The cancer has one or more of the following features:

- Spread to the chest wall, the *diaphragm* (breathing muscle that separates the chest from the abdomen), the *mediastinal pleura* (membranes surrounding the space between the two lungs), or *parietal pericardium* (membranes of the sac surrounding the heart).
- Involves a main bronchus and is closer than 2 cm (about ¾ inch) to the point where the *trachea* (windpipe) branches into the left and right main bronchi, but does not involve this area
- Has grown into the airways enough to cause one lung to entirely collapse or to cause pneumonia in the entire lung

T4: The cancer has one or more of the following features:

- Spread to the *mediastinum* (space behind the chest bone and in front of the heart), the heart, the *trachea* (windpipe), the *esophagus* (tube connecting the throat to the stomach), the backbone, or the point where the windpipe branches into the left and right main bronchi
- Two or more separate tumor nodules are present in the same lobe
- There is a *malignant pleural effusion* (fluid containing cancer cells in the space surrounding the lung)

Non-small Cell Lung Cancer N Stages

N0: No spread to lymph nodes

N1: Spread to lymph nodes within the lung and/or *hilar lymph nodes* (located around the area where the bronchus enters the lung). Metastases affect lymph nodes only on the same side as the cancerous lung.

N2: Spread to lymph nodes around the point where the windpipe branches into the left and right bronchi or to lymph nodes in the *mediastinum* (space behind the chest bone and in front of the heart). Affected lymph nodes are on the same side of the cancerous lung.

N3: Spread to lymph nodes near the collar bone on either side, to hilar or mediastinal lymph nodes on the side opposite the cancerous lung.

Non-small Cell Lung Cancer M Stages

M0: No distant spread

M1: Distant spread is present. Sites considered distant include other lobes of the lungs, lymph nodes further than those mentioned in N stages, and other organs or tissues such as the liver, bones, or brain.

Stage Grouping for Non-small Cell Lung Cancer

Once the T, N, and M categories have been assigned, this information is combined (stage grouping) to assign an overall stage of 0, I, II, III, or IV. Patients with lower stage numbers have a better prognosis.

<u>Overall Stage</u>	<u>T Stage</u>	<u>N Stage</u>	<u>M Stage</u>
Stage 0	Tis (In situ)	N0	M0
Stage IA	T1	N0	M0

Stage IB	T2	N0	M0
Stage IIA	T1	N1	M0
Stage IIB	T2	N1	M0
	T3	N0	M0
Stage IIIA	T1	N2	M0
	T2	N2	M0
	T3	N1	M0
	T3	N2	M0
Stage IIIB	Any T	N3	M0
	T4	Any N	M0
Stage IV	Any T	Any N	M1

Staging of Small Cell Lung Cancer

Although small cell lung cancers can be staged like NSCLC, most doctors prefer a 2-stage system. These are "*limited stage*" and "*extensive stage*." Limited stage usually means that the cancer is only in one lung and in lymph nodes on the same side of the chest.

Spread of the cancer to the other lung, to lymph nodes on the other side of the chest, or to distant organs indicates extensive disease. Many doctors consider small cell lung cancer that has spread to the fluid around the lung an extensive stage.

Small cell lung cancer is staged in this way because it helps separate patients who have a fair prognosis and may be cured, from those who have a worse outlook with no chance of cure. About two-thirds of the people with small cell lung cancer will have extensive disease when their cancer is first found.

How Is Lung Cancer Treated?

General Comments About Sources of Treatment Information

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 colorectal cancer treatment studies published in medical journals, as well as their own professional experience. The treatment information in this document is not, however, 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 cancer care team. Don't hesitate to ask them questions about your treatment options. In addition to the information in this document, we encourage interested patients to seek out treatment information from other reliable sources.

If you have lung cancer, your treatment options are surgery, radiation therapy, and chemotherapy, either alone or in combination, depending on the stage of your cancer.

After the cancer is found and staged, your cancer care team will discuss *treatment options* (choices) with you. It is important to take time and think about all of your possible choices. In choosing a treatment plan, the most significant factors to consider are the type of cancer (small cell or non-small cell) and the stage of the cancer. For this reason, it is very important that your

doctor perform all the tests needed to determine the stage of the cancer. Other factors to consider include your overall physical health, likely side effects of the treatment, and the probability of curing the disease, extending life, or relieving symptoms.

In considering your treatment options it is often a good idea to seek a second opinion. A second opinion can provide more information and help you feel more confident about the treatment plan you have chosen.

Types of Treatment for Lung Cancer

Surgery: Depending on the type and stage of a lung cancer, surgery may be used to remove the cancer along with some surrounding lung tissue.

- If a *lobe* (section) of the lung is removed, it is called a *lobectomy*.
- If the entire lung is removed, the surgery is called a *pneumonectomy*.
- Removing part of a lobe is known as a *segmentectomy* or *wedge resection*.

These operations require *general anesthesia* (you are "asleep") and a having a surgical incision in the chest (called thoracotomy). You will generally spend 1 to 2 weeks in the hospital. Possible complications include excessive bleeding, wound infections, and pneumonia. Because the surgeon must cut through ribs to get to the lung, these will hurt for some time after surgery. Your activity will be limited for at least a month or two.

If your lungs are in good condition (other than the presence of the cancer) you can usually return to normal activities after a lobe or even an entire lung has been removed. However, if your lungs have been damaged and you have noncancerous diseases such as emphysema or chronic bronchitis (which are common among heavy smokers), you may become short of breath after surgery. *Pulmonary function tests* are done before surgery to determine whether you will have enough healthy lung tissue remaining after surgery.

If you can't undergo a thoracotomy because of lung disease or other serious medical problems, or if the cancer is widespread, other types of surgery can be used to relieve some symptoms. For example, laser surgery can be used to relieve blockage of airways that may be causing pneumonia or shortness of breath.

If your lung cancer has spread to your brain, you may benefit from removal of the brain metastasis. This involves a *craniotomy* (surgery through a hole in the skull). It should only be done if the tumor can be removed without damage to the brain.

Radiation Therapy: Radiation therapy uses high- energy radiation to kill cancer cells.

- *External beam radiation therapy* uses radiation delivered from outside the body that is focused on the cancer. This is the type of radiation therapy most often used to treat a primary lung cancer or its metastases to other organs.

- *Brachytherapy* uses a small pellet of radioactive material placed directly into the cancer or into the airway next to the cancer.

Radiation therapy is sometimes used as the main (*primary*) treatment of lung cancer, especially if your general health is too poor to undergo surgery. Brachytherapy can also be used to help relieve blockage of large airways by cancer.

After surgery, radiation therapy can be used to kill very small deposits of cancer that cannot be seen and removed during surgery. Radiation therapy can also be used to *palliate* (relieve) symptoms of lung cancer such as pain, bleeding, difficulty swallowing, and problems caused by brain metastases.

Side effects of radiation therapy may include mild skin problems, nausea, vomiting, and fatigue. Often these go away after a short while. Radiation may also make the side effects of chemotherapy worse. Chest radiation therapy may damage your lungs and cause difficulty breathing and shortness of breath. Your esophagus which is located in the middle of your chest, will be exposed to radiation. For this reason, you may have difficulty swallowing during the treatment. This will improve shortly after treatment is over.

Radiation therapy to large areas of the brain can sometimes change your brain function. You may notice memory loss, headache, difficulty thinking, or diminished sexual desire. Usually these symptoms are minor compared to those caused by a brain tumor; nevertheless, they can reduce your quality of life. Side effects of radiation therapy to the brain usually become most serious one or two years after treatment.

Chemotherapy: Chemotherapy is treatment giving anticancer drugs into a vein or by mouth. These drugs enter the bloodstream and reach all areas of the body, making this treatment useful for cancer that has spread or metastasized to organs beyond the lung. Depending on the type and stage of lung cancer, chemotherapy may be given as the main (*primary*) treatment or as an addition (*adjuvant*) to surgery. Chemotherapy for lung cancer generally uses a combination of anticancer drugs.

Cisplatin or a related drug, carboplatin, are the chemotherapy agents most often used in treating NSCLC. Recent studies found that combining either of these with drugs such as gemcitabine, paclitaxel, docetaxel, etoposide, or vinorelbine appear to be more effective in treating NSCLC. The best ways to use these drugs in combination is still being tested in clinical trials.

Some of the usual chemotherapy combinations used for patients with SCLC include:

- EP (etoposide and cisplatin)
- ET (etoposide and carboplatin)
- ICE (ifosfamide, carboplatin, and etoposide)
- CAV (cyclophosphamide, doxorubicin, and vincristine).

New drugs such as gemcitabine, paclitaxel, vinorelbine, topotecan, and teniposide have shown promising results in some SCLC studies. If you are in relatively good health, your doctors might give you larger doses of chemotherapy along with drugs called growth factors. These help prevent the bone marrow side effects of chemotherapy.

Chemotherapy drugs kill cancer cells but also damage some normal cells. Therefore, your doctors will pay careful attention to avoiding or minimizing side effects. These depend on the type of drugs, the amount taken, and the length of treatment. Temporary side effects might include nausea and vomiting, loss of appetite, loss of hair, and mouth sores.

Because chemotherapy can damage the blood-producing cells of the bone marrow, you may have low blood cell counts. This can increase your risk of infection (due to a shortage of white blood cells), bleeding or bruising after minor cuts or injuries (due to a shortage of blood platelets), and fatigue or shortness of breath (due to low red blood cell counts). Since cisplatin or paclitaxel can damage nerves, you might feel numbness, particularly in your fingers and toes, and sometimes your arms and legs might feel weak.

Some side effects disappear within a few days after treatment. There are remedies for many of these temporary side effects of chemotherapy. For example, your doctor can prescribe *antiemetic* drugs for you to prevent or reduce nausea and vomiting.

Clinical Trials

The purpose of clinical trials: Studies of promising new or experimental treatments in patients are known as clinical trials. A clinical trial is only done when there is some reason to believe that the treatment being studied may be valuable to the patient. Treatments used in clinical trials are often found to have real benefits. Researchers conduct studies of new treatments to answer the following questions:

- Is the treatment helpful?
- How does this new type of treatment work?
- Does it work better than other treatments already available?
- What side effects does the treatment cause?
- Are the side effects greater or less than the standard treatment?
- Do the benefits outweigh the side effects?
- In which patients is the treatment most likely to be helpful?

Types of clinical trials: There are three phases of clinical trials in which a treatment is studied before it is eligible for approval by the FDA (Food and Drug Administration).

Phase I clinical trials: The purpose of a Phase I study is to find the best way to give a new treatment and how much of it can be given safely. Physicians watch patients carefully for any harmful side effects. The treatment has been well tested in laboratory and animal studies, but the side effects in patients are not completely known. Doctors conducting the clinical trial will start by giving very low doses of the drug to the first patients and increasing the dose for later groups of patients until side effects appear. Although doctors are hoping to help patients, the main purpose of a phase I study is to test the safety of the drug.

Phase II clinical trials: These are designed to see if the drug works. Patients are given the highest dose that doesn't cause severe side effects (determined from the phase I study) and closely observed for an effect on the cancer. The doctors will also look for side effects.

Phase III clinical trials: These Phase III studies involve large numbers of patients. Some clinical trials may enroll thousands of patients. One group (the control group) will receive the

standard (most accepted) treatment. The other groups will receive the new treatment. Usually doctors study only 1 new treatment to see if it works better than the standard treatment, but sometimes they will test 2 or 3. All patients in Phase III studies are closely watched. The study will be stopped if the side effects of the new treatment are too severe or if one group has had much better result than the others.

If you are in a clinical trial, you will receive excellent care. You will have a team of experts looking at you and monitoring your progress very carefully. The study is especially designed to pay close attention to you.

There are, however, some risks. No one involved in the study knows in advance whether the treatment will work or exactly what side effects will occur. That is what the study is designed to discover. While most side effects will disappear in time, some can be permanent or even life threatening. Keep in mind, though, that even standard treatments have side effects. Depending on many factors, you may decide to enroll in a clinical trial.

Deciding to enter a clinical trial: Enrollment in any clinical trial is completely up to you. Your doctors and nurses will explain the study to you in detail and will give you a form to read and sign indicating your desire to take part. This process is known as giving your informed consent. Even after signing the form and after the clinical trial begins, you are free to leave the study at any time, for any reason. Taking part in the study will not prevent you from getting other medical care you may need.

To find out more about clinical trials, ask your cancer care team. Among the questions you should ask are:

- What is the purpose of the study?
- What kinds of tests and treatments does the study involve?
- What does this treatment do?
- What is likely to happen in my case with, or without, this new research treatment?
- What are my other choices and their advantages and disadvantages?
- How could the study affect my daily life?
- What side effects can I expect from the study? Can the side effects be controlled?
- Will I have to be hospitalized? If so, how often and for how long?
- Will the study cost me anything? Will any of the treatment be free?
- If I am harmed as a result of the research, what treatment would I be entitled to?
- What type of long-term follow-up care is part of the study?
- Has the treatment been used to treat other types of cancers?

You can get a list of current clinical trials by calling the National Cancer Institute's Cancer Information Service toll free or visiting the NCI clinical trials Web sites for patients cancertrials.nci.nih.gov or health care professionals ancernet.nci.nih.gov/prot/protsrch.shtml

Treatment Choices by Stage for Non-Small Cell Lung Cancer (NSCLC)

Stage 0: Because stage 0 cancers are limited to the lining layer of air passages and have not invaded the nearby lung tissue, they are curable by surgery alone. No chemotherapy or radiation therapy is needed.

You can be treated by *segmentectomy* or *wedge resection* (surgical removal of defined segments or small wedges). Cancers in some locations (where the windpipe divides into the left and right main bronchi) are difficult to remove completely by surgery without also removing an entire lung.

Endoscopic photodynamic therapy (killing cancer cells by sensitizing them with an injected chemical and activating the chemical by shining a bright light directly on the cancer) is being tested in this situation and may be a useful alternative to surgery for stage 0 cancers. If you are truly stage 0, treatment will probably cure you.

Stage I: If you have stage I NSCLC your treatment will probably be only surgery. This can be removal of the tumor by a *lobectomy* (removal of one lobe) or by some less extensive surgery such as segmentectomy or wedge resection. Although additional (*adjuvant*) chemotherapy after surgery for stage I NSCLC is being studied in clinical trials, but is not routinely recommended at this time.

Segmentectomy or wedge resection is recommended only for treating the smallest stage I cancers and for patients with other medical conditions that make removing the entire lobe dangerous. Most surgeons believe it is better to perform a lobectomy if the patient can tolerate it. Your expected 5-year survival rate will be around 60% to 80%.

If you have serious medical problems, you may receive only radiation therapy as your main treatment.

Stage II: If you have stage II NSCLC you will have your cancer surgically removed by lobectomy or by some less extensive surgery such as a segmentectomy. A wedge resection might be done if you cannot withstand lobectomy. After surgery, radiation therapy may be used to destroy cancer cells left behind after surgery, especially if cancer cells are present at the edge of the tissue removed by surgery. Even if the edges of the sample have no detectable cancer cells, some doctors may recommend additional radiation therapy. Your expected 5-year survival rate is about 35%, if you undergo surgery.

If you have serious medical problems, you may receive only radiation therapy as your main treatment.

The role of adjuvant chemotherapy for completely resected Stage II lung cancer is being studied in clinical trials. So far chemotherapy has not shown a benefit and is not recommended outside of a clinical trial. It may also be used if you cannot tolerate surgery and are treated with radiation only.

Stage IIIA: If you have stage IIIA NSCLC your treatment will depend where the cancer is located in your lung and which lymph nodes it has spread to.

Surgery may be used alone, if your surgeon thinks all the cancer can be removed successfully. Often you will receive radiation therapy sometimes along with chemotherapy after the surgery. Some doctors will recommend that chemotherapy or radiation therapy or both be given before

surgery, with the goal of shrinking your cancer tumor enough that it can be completely removed by surgery. This has not been shown to be better than giving these treatments after surgery.

If you don't have surgery because you have other serious medical conditions and cannot withstand surgery, your cancer can be treated by radiation therapy or by both radiation therapy and additional chemotherapy. There are several clinical trials in progress to determine the best treatment for people with this stage of lung cancer.

Brachytherapy is sometimes used. In some cases, a laser can be passed through a bronchoscope to destroy part of the cancer within the airway.

Average five year survival rates vary in the range of 10% to 20%, but some stage IIIA patients may have a better outlook.

Stage IIIB: Stage IIIB NSCLC has spread too widely to be completely removed by surgery. The overall 5-year survival rate is about 5%, but if you are in relatively good health you may be helped by combined chemotherapy and radiation therapy. In some cases, you may be able to have surgery after chemotherapy or radiation therapy. There are several clinical trials in progress to determine the best treatment for people with this stage of lung cancer.

Stage IV: Because stage IV NSCLC has spread to distant organs, a cure is not possible. If any aggressive therapy is used, the goal of treatment should be clear to you and your family. If you are in otherwise good health, chemotherapy can help you live longer, even though it won't cure you. If you have an airway blocked by cancer you can be treated by brachytherapy or by using a laser passed through a bronchoscope to destroy the part of the cancer in your airway. External beam radiation therapy can also treat complications of cancer in the lungs as well as problems from metastatic growth such as bone pain and nervous system symptoms.

Several reports have shown that chemotherapy can prolong your life if you have stage IV lung cancer. It can also improve your quality of life, even though there are side effects from the chemotherapy. Only 20% to 25% of people with stage IV lung cancer live 1 year.

If you have extensive cancer or are in otherwise poor health, you might want to consider palliative care, perhaps in the setting of a good hospice program. Many people with lung cancer are concerned about pain and you might be also. As the cancer grows around certain nerves it may cause severe pain. However, you can effectively relieve this pain with medication. Sometimes radiation therapy will help. It is important that you talk to your doctor and take advantage of these treatments.

If you have had chemotherapy and it is not working, you might also want to consider palliative care. A second kind of chemotherapy will rarely help people with lung cancer. If you have incurable lung cancer you should try to get the most out of your life by making every day count. That means you should be as free of symptoms as possible. If you want to continue anti-cancer treatment, you might think about participating in a clinical trial of new chemotherapy drugs or other new treatments such as immunotherapy or gene therapy. These are worthwhile options that may benefit you as well as future patients.

Treatment Choices by Stage for Small Cell Lung Cancer (SCLC)

This type of cancer is usually staged as either *limited* or *extensive*. Studies show that this type of lung cancer has usually spread by the time it is found (even if that spread is not shown by x-rays and other imaging tests) so SCLC usually cannot be cured by surgery alone.

Limited stage: If you have limited stage SCLC you will receive chemotherapy. The most commonly used treatment is a combination of two or more chemotherapy drugs. These will be either cisplatin or carboplatin combined with etoposide, usually given for around 6 months. There are trials in progress to determine whether adding the drug paclitaxel will improve survival.

Many studies have been performed to determine whether radiation treatment to the chest (usually the middle where the cancer spreads to lymph nodes) will improve your outcome over chemotherapy alone. These studies have shown that radiation does provide a small benefit. However you will have more toxicity with radiation therapy in addition to chemotherapy. You may have more trouble breathing because of lung damage and also trouble swallowing because your esophagus is in the field of radiation.

Chest radiation therapy is not given if you have severe lung disease (in addition to your cancer) or some other types of serious health problems. Sometimes if your SCLC is very localized, the cancer is removed by surgery and followed by combination chemotherapy.

SCLC commonly spreads to the brain. If no preventive measures are taken, about 50% of people with SCLC will have metastasis to their brain. For this reason, if you have responded well to initial treatment, you may be given brain radiation therapy to prevent brain metastasis. This also may slightly increase your chance of longer survival. One problem is that doctors have reported that patients given brain irradiation may suffer side effects such as trouble with memory and clumsiness. It is not totally clear that these symptoms are a direct result of the radiation. Most doctors will recommend brain radiation therapy if you have had a complete remission (all the apparent cancer is gone) after chemotherapy.

If you are treated with chemotherapy, with or without radiation therapy, it is likely that your tumor will shrink and you will go into *remission*. Sooner or later, though, your cancer will begin to grow again.

The 1-year survival rate for people with limited stage SCLC who are treated with chemotherapy and radiation therapy (this is the most favorable group) is 60%. It goes down to 30% at 2 years, and 10% to 15% by 5 years. Because of this lack of success, doctors are studying other methods of treating these cancers. Clinical trials of new chemotherapy drugs or other new treatments such as immunotherapy or gene therapy are a worthwhile option that may benefit the individual patient as well as future patients.

Extensive stage: If you have extensive SCLC, chemotherapy can treat your symptoms and also allow you to live longer. The chance of your cancer shrinking with chemotherapy is about 70% to 80%. Once again, carboplatin or cisplatin along with etoposide are the usual drugs given. However, the cancer eventually becomes resistant to treatment. Radiation therapy is sometimes used to control symptoms of growth within the lung or spread to the bones or brain. Preventive brain radiation therapy is sometimes given.

About 20% to 30% of people with extensive SCLC live 1 year. By 2 years, only about 5% are still alive. Only 1% to 2% of people with extensive SCLC survive 5 years after the cancer is found. If you are too ill to have chemotherapy, the best plan may be to have supportive care. This would include treatment of any pain, breathing problems, or other symptoms you might have. Pain can be a major problem if you have extensive lung cancer. Growth of the cancer around certain nerves may cause severe pain. However, medications can effectively relieve this pain. Radiation therapy may also be helpful. It is important that you take advantage of these treatments. Even if you have incurable lung cancer, you should try to get the most out of your life by making every day count. That means that you should be as free of symptoms as possible. You might consider a clinical trial of new chemotherapy drugs or other new treatments such as immunotherapy or gene therapy. This can be a worthwhile option that may benefit you as well as future patients.

What Should You Ask Your Doctor About Lung Cancer?

It is important for you to have honest, open discussions with your cancer care team. They want to answer all of your questions, no matter how trivial you might think they are.

- What kind of lung cancer do I have?
- Has my cancer spread beyond the primary site?
- What is the stage of my cancer and what does that mean in my case?
- What treatment choices do I have?
- What do you recommend and why?
- What is my expected survival rate, based on my cancer as you view it?
- What risks or side effects are there to the treatments you suggest?
- What are the chances of recurrence of my cancer with these treatment plans?
- What should I do to be ready for treatment?

In addition to these sample questions, be sure to write down some of your own. For instance, you might want more information about recovery times so you can plan your work schedule. Or, you may want to ask about second opinions or about clinical trials for which you may qualify.

What Happens After Treatment for Lung Cancer?

Follow-up care is important after treatment. Your health care team will explain what tests you need and how often they should be done. Make a special effort to keep all appointments with your cancer care team and follow their instructions carefully. The health care team will determine which tests should be done and how often, based on the type of lung cancer, its stage at diagnosis, and its response to treatment.

- Your doctor will take a medical history and physically examine you to check for new symptoms or signs that might indicate your cancer is recurring or progressing.
- Chest x-rays may be taken to look for a recurrence or for a new tumor. It is not uncommon for a new lung cancer to develop.
- Blood tests may be done to help monitor for recurrent cancer and for certain side effects of treatment.

- Additional blood tests and imaging tests may be performed, based on the results of routine tests and exams.
- It is important for you to report any new or recurring symptoms to your doctor right away so that any problems related to a recurrent cancer or side effects of treatment can be dealt with promptly.

Each type of treatment for lung cancer has adverse effects that may last for a few months; some complications, however, can be permanent. You may be able to speed up your recovery by being aware of the side effects before you start treatment. You might be able to take steps to prevent them or shorten the length of time they last.

Remember that your body is unique, and so are your emotional needs and your personal circumstances. In some ways, your cancer is like no one else's. No one can predict precisely how you will respond to cancer or its treatment. Statistics can paint an overall picture, but you may have special strengths such as a healthy immune system, a history of good nutrition, a strong family support system, or a deep spiritual faith. All of these have an affect on how you cope with cancer.

If you are being treated for cancer, be aware of the battle that is going on in your body. Radiation therapy and chemotherapy add to the fatigue caused by the disease itself. Rest as much as you need to so that you will feel better as time goes on. Exercise once you feel rested enough. Ask your cancer care team whether your cancer or its treatments might limit your exercise program or other activities.

Do as much as you can to help yourself stay healthy and active. Even after a diagnosis of lung cancer is made, it still is very important that you quit smoking. Quitting helps improve your appetite and overall health and can reduce your chance of developing a new cancer.

Ask your health care team for suggestions about how to quit smoking. Eat a balanced diet of healthy foods, including plenty of fruits, vegetables, and whole grains. Once you get your strength back, try to exercise a few hours each week. Your health care team can suggest the types of exercise that are right for you.

A cancer diagnosis and its treatment are major life challenges, with an affect on you and everyone who cares for you. Before you get to the point where you feel overwhelmed, consider attending a meeting of a local support group. There are many groups available that provide emotional support, friendship, and understanding. Your health care team can suggest other organizations that might help you during your recovery from treatment. If you need individual assistance in other ways, contact your hospital's social service department or call us (1-800-ACS 2345) for help in contacting counselors or other services.

What's New In Lung Cancer Research and Treatment?

Progress in prevention, early detection, and treatment based on current research is expected to save many thousands of lives each year. Lung cancer research is currently being done in medical centers throughout the world.

Prevention

At this time, many researchers believe that prevention offers the greatest opportunity to fight lung cancer. Although decades have passed since the link between smoking and lung cancers was clearly identified, scientists estimate that smoking is still responsible for about 87% of lung cancers. Research is continuing on:

- Ways to help people quit smoking through counseling, nicotine replacement, and other medications.
- Ways to convince young people to never start smoking.
- Inherited differences in genes that may make some people exceptionally likely to get lung cancer if they smoke or are exposed to someone else's smoke.
- Ways to prevent lung cancer in people at high risk by using vitamins or medication. One of these, called 13-cis-retinoic acid, a substance chemically related to vitamin A, may be tested soon. Studies have focused on smokers including those who have already received treatment for a smoking-related cancer (lung, larynx, mouth, etc.). Earlier studies found that smokers who ate a diet high in vegetables had a lower lung cancer risk than smokers who ate fewer vegetables. Some researchers concluded that regular vitamin A supplements actually increased lung cancer risk among smokers. Studies of other vitamins and new chemopreventive agents continue. But for now many researchers think that simply following the American Cancer Society dietary recommendations (such as choosing most foods from plant sources and eating at least five servings of fruits and vegetables each day) may be the best strategy.

Earlier Diagnosis

Nearly 20 years ago, large studies were done to determine whether routine chest x-rays and sputum cytology testing could save lives. Most researchers concluded that these tests did not find lung cancers early enough to significantly lower the risk of death from lung cancer. However, some researchers disagree about the best way to interpret the studies' data and the debate continues.

Many researchers believe that new technology will make early lung cancer detection possible. Preliminary results suggest that special computed tomography (CT) scans called low-dose spiral or helical CT scans, can find lung cancers early enough to save lives among people at high risk for developing lung cancer. Another approach uses new ways to more sensitively detect cancer cells in sputum samples.

Researchers have recently found several changes that often affect the DNA of lung cancer cells. Current studies are evaluating new diagnostic tests that specifically recognize these DNA changes to see if this approach is useful in finding lung cancers at an earlier stage.

Treatment

Chemotherapy: Many clinical trials are testing new chemotherapy drugs. Some studies are testing whether the effectiveness of drugs known to be active against lung cancer can be improved by combining them with each other. Other studies are testing the best ways to combine chemotherapy with radiation therapy and to decrease the side effects of certain chemotherapy drugs.

Immunotherapy: Treatments that boost the patient's immune system to fight lung cancer more effectively are being tested in clinical trials.

Some treatments use drugs like interferons and interleukins that boost the immune system in general. In active immunotherapy, the patient is given a vaccine that might cause the immune system to recognize some of the abnormal substances in lung cancer cells and as a result, kill these cells. For example, the *K-ras* or the *p53* gene products are altered in many lung cancers and researchers are testing ways to help the patient's immune system attack cells with these altered proteins.

Passive immunotherapy injects man-made antibodies that into patients to seek out lung cancer cells that contain abnormal oncogene or tumor suppressor gene proteins. Toxins or radioactive atoms can be attached to these antibodies, so that the cell-killing chemicals or radiation is targeted specifically to the cancer cells. Therefore, healthy cells of the body are not affected.

Gene therapy: Great advances were made during the past 20 years in understanding how DNA changes cause cells to become cancerous, and how DNA regulates the immune system's response to cancer cells. Many researchers believe this progress can be applied to develop more effective ways of treating lung cancer through *gene therapy*.

Researchers are developing ways to alter lung cancers by adding extra DNA so that cancer cells are better recognized and more effectively attacked by the patient's immune system. They are using DNA to repair the gene mutations thought to be responsible for the lung cell's original transformation into a cancer cell. These and other gene therapy strategies are currently being tested in phase I clinical trials and some show encouraging preliminary results. In one study, a gene that makes a tumor- suppressing material called *p53* was placed in a genetically modified virus. The virus was then injected into patients with lung cancer. In some of the patients, the tumors shrank.

Additional Resources

National Organizations and Web Sites

The following organizations can also provide additional information and resources. *

Alliance for Lung Cancer Advocacy, Support & Education (ALCASE)

Telephone: 1-800-298-2436 (United States only)

Toll Number: 360-699-1944

Internet Address: www.alcase.org

National Cancer Institute

Telephone: 1-800-4-CANCER

Internet Address: www.nci.nih.gov

The American Lung Association
Telephone: 1-800-586-4872 or (212) 315-8700
Internet Address: www.lungusa.org

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

Additional American Cancer Society Information

Caregiving: A Step-By-Step Resource for Caring for the Person with Cancer at Home (Book; Code #9422.00)

Questions About Smoking, Tobacco and Health (Booklet #2023.00)

Understanding Chemotherapy (Booklet #9458.00)

Understanding Radiation Therapy (Booklet #9459.00)

After Diagnosis: A Guide for Patients and Families (Booklet; Code #9440)

Other Publications*

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

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