Lung Cancer (Small Cell)

What is cancer?

The body is made up of trillions of living cells. Normal body cells grow, divide into new cells, 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 (and treated) based on the place where it started. For example, breast cancer that has spread to the liver is still breast cancer, not liver cancer. Likewise, prostate cancer that has spread to the bone is still 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 small cell lung cancer?

Note: *This document is specifically about the small cell type of lung cancer. Treatment for the two major types of lung cancer (small cell vs. non-small cell) is very different, so much of the information for one type will not apply to the other type. If you are not sure which type of lung cancer you have, it is very important to ask your doctor so you can be sure the information you receive is correct.*

Lung cancer is a cancer that starts in the lungs. To understand lung cancer, it helps to know about the normal structure and function of the lungs.

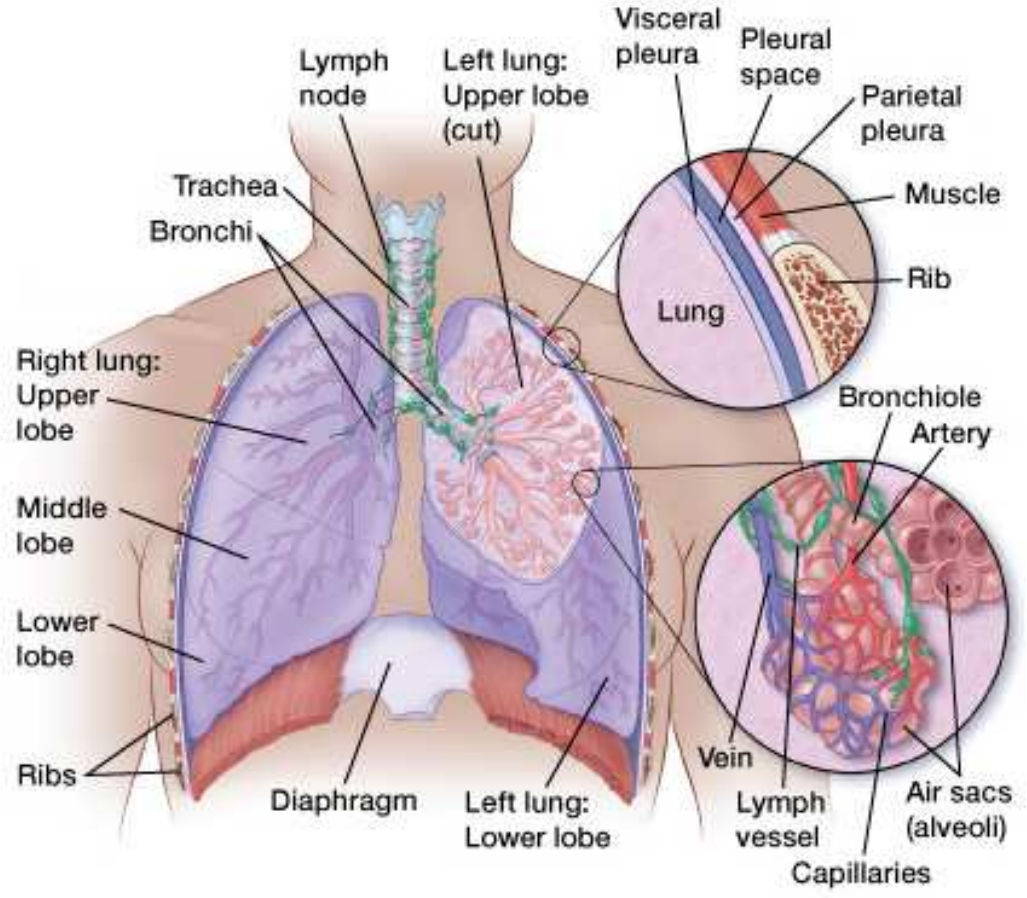
The lungs

Your lungs are 2 sponge-like organs in your chest. Your right lung is divided into 3 sections, called *lobes*. Your left lung has 2 lobes. The left lung is smaller because your heart takes up more room on that side of the body.

When you breathe in, air enters through your mouth and nose and goes into your lungs through the *trachea* (windpipe). The trachea divides into tubes called the *bronchi* (singular, *bronchus*), which enter the lungs and 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. They absorb oxygen from the inhaled air into your bloodstream and pass carbon dioxide from the body into the alveoli. This is

expelled from the body when you exhale. Taking in oxygen and getting rid of carbon dioxide are your lungs' main functions.



A thin lining called the *pleura* surrounds the lungs. The pleura protects your lungs and helps them slide back and forth against the chest wall as they expand and contract during breathing.

Below the lungs, a thin, dome-shaped muscle called the *diaphragm* separates the chest from the abdomen. When you breathe, the diaphragm moves up and down, forcing air in and out of the lungs.

Start and spread of lung cancer

Lung cancers start in the cells lining the bronchi and in other parts of the lung such as the bronchioles or alveoli.

Lung cancers are thought to start as areas of pre-cancerous changes in the lung. The first changes in the genes (DNA) inside the lung cells may cause the cells to grow faster. These cells may look a bit abnormal if seen under a microscope, but at this point they do

not form a mass or tumor. They cannot be seen on an x-ray and they do not cause symptoms.

Over time, the abnormal cells may acquire other gene changes, which cause them to progress to true cancer. As a cancer develops, the cancer cells may make chemicals that cause new blood vessels to form nearby. These blood vessels nourish the cancer cells, which can continue to grow and form a tumor large enough to be seen on imaging tests such as x-rays.

At some point, cells from the cancer may break away from the original tumor and spread (metastasize) to other parts of the body. Lung cancer is often a life-threatening disease because it tends to spread in this way even before it can be detected on an imaging test such as a chest x-ray.

The lymph (lymphatic) system

The lymph system is one of the ways in which lung cancers can spread. This system has several parts:

- *Lymph nodes* are small, bean-shaped collections of immune system cells (cells that fight infections) that are connected by lymphatic vessels.
- *Lymphatic vessels* are like small veins, except that they carry a clear fluid called lymph (instead of blood) away from the lungs.
- *Lymph* contains excess fluid and waste products from body tissues, as well as immune system cells.

Lung cancer cells can enter lymphatic vessels and begin to grow in lymph nodes around the bronchi and in the mediastinum (the area between the 2 lungs). Once lung cancer cells have reached the lymph nodes, they are more likely to have spread to other organs of the body as well. The stage (extent) of the cancer and decisions about treatment are based in part on whether or not the cancer has spread to the nearby lymph nodes in the mediastinum. These topics are discussed later in the section “How is small cell lung cancer staged?”

Types of lung cancer

There are 2 major types of lung cancer:

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

(If a lung cancer has some cells with characteristics of SCLC and other cells with characteristics of NSCLC it is called a *combined small cell/non-small cell cancer*. This is uncommon.)

These 2 types of lung cancer are treated very differently. **This document focuses on small cell lung cancer.** Non-small cell lung cancer is discussed in the separate document, *Lung Cancer (Non-Small Cell).*

Small cell lung cancer

About 10% to 15% of all lung cancers are small cell lung cancer (SCLC), named for the size of the cancer cells when seen under a microscope. Other names for SCLC are *oat cell cancer*, *oat cell carcinoma*, and *small cell undifferentiated carcinoma*.

SCLC often starts in the bronchi near the center of the chest. It tends to grow and spread quickly, and it has almost always spread to distant parts of the body before it is found.

Non-small cell lung cancer

About 85% to 90% of lung cancers are non-small cell lung cancer (NSCLC). There are 3 main subtypes of NSCLC:

- Adenocarcinoma
- Squamous cell carcinoma
- Large cell carcinoma

The cells in these subtypes differ in size, shape, and chemical make-up when looked at under a microscope. But they are grouped together because the approach to treatment and prognosis (outlook) are similar. They are discussed further in our document *Lung Cancer (Non-Small Cell).*

Other types of lung cancer

Along with the 2 main types of lung cancer, other tumors can occur in the lungs.

Lung carcinoid tumors: Carcinoid tumors of the lung account for less than 5% of lung tumors. Most are slow-growing tumors that are called *typical carcinoid tumors*. They are generally cured by surgery. Some typical carcinoid tumors can spread, but they usually have a better prognosis (outlook) than small cell or non-small cell lung cancer. *Atypical carcinoid tumors* are less common. The outlook for these tumors is somewhere in between typical carcinoids and small cell lung cancer. For more information about typical and atypical carcinoid tumors, see our document, *Lung Carcinoid Tumor*.

Other lung tumors: Other types of lung tumors such as adenoid cystic carcinomas, hamartomas, lymphomas, and sarcomas, are rare and are treated differently from the more common lung cancers. They are not discussed in this document.

Cancers that spread to the lungs: Cancers that start in other organs (such as the breast, pancreas, kidney, or skin) can sometimes spread (metastasize) to the lungs, but these are not lung cancers. For example, cancer that starts in the breast and spreads to the lungs is still breast cancer, not lung cancer. Treatment for metastatic cancer to the lungs is based on where it started (the primary cancer site). For information on these cancers, refer to our separate documents on each.

What are the key statistics about lung cancer?

Most lung cancer statistics include both small cell and non-small cell lung cancers. In general, small cell lung cancer accounts for about 10% to 15% of all lung cancers.

Lung cancer (both small cell and non-small cell) is the second most common cancer in both men and women (not counting skin cancer). In men, prostate cancer is more common, while in women breast cancer is more common. Lung cancer accounts for about 13% of all new cancers.

The American Cancer Society's estimates for lung cancer (including both small cell and non-small cell) in the United States for 2015 are:

- About 221,200 new cases of lung cancer (115,610 in men and 105,590 among women)
- An estimated 158,040 deaths from lung cancer (86,380 in men and 71,660 among women), accounting for about 27% of all cancer deaths

Lung cancer accounts for more than a quarter of all cancer deaths and is by far the leading cause of cancer death among both men and women. Each year, more people die of lung cancer than of colon, breast, and prostate cancers combined.

Lung cancer mainly occurs in older people. About 2 out of 3 people diagnosed with lung cancer are 65 or older; fewer than 2% of all cases are found in people younger than 45. The average age at the time of diagnosis is about 70.

Overall, the chance that a man will develop lung cancer in his lifetime is about 1 in 13; for a woman, the risk is about 1 in 16. These numbers include both smokers and non-smokers. For smokers the risk is much higher, while for non-smokers the risk is lower.

Black men are about 20% more likely to develop lung cancer (including all types) than are white men. The rate is about 10% lower in black women than in white women. Both black and white women have lower rates than men, but the gap is closing. The lung

cancer rate has been dropping among men over the past 2 decades, but has just recently begun to drop in women.

In contrast, black men are about 15% *less* likely to develop small cell lung cancer than are white men, and the risk is about 30% lower in black women than in white women.

Statistics on survival in people with lung cancer vary depending on the stage (extent) of the cancer when it is diagnosed. Survival statistics based on the stage of the cancer are discussed in the section "Small cell lung cancer survival rates by stage"

What are the risk factors for small cell lung cancer?

A risk factor is anything that affects your chance of getting a disease such as cancer. Different cancers have different risk factors. Some risk factors, like smoking, can be changed. Others, like a person's age or family history, can't be changed.

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 some people who get the disease may not have had any known risk factors. Even if a person with lung cancer has a risk factor, it is often very hard to know how much that risk factor may have contributed to the cancer.

Several risk factors can make you more likely to develop lung cancer.

Tobacco smoke

Smoking is by far the leading risk factor for lung cancer. In the early 20th century, lung cancer was much less common than some other types of cancer. But this changed once manufactured cigarettes became readily available and more people began smoking.

At least 80% of all lung cancer deaths are thought to result from smoking, and this number is probably even higher for small cell lung cancer. It is very rare for someone who has never smoked to have small cell lung cancer. The risk for lung cancer among smokers is many times higher than among non-smokers. The longer you smoke and the more packs per day you smoke, the greater your risk.

Cigar smoking and pipe smoking are almost as likely to cause lung cancer as cigarette smoking. Smoking low-tar or "light" cigarettes increases lung cancer risk as much as regular cigarettes. There is concern that menthol cigarettes may increase the risk even more, as the menthol may allow smokers to inhale more deeply.

Secondhand smoke: If you don't smoke, breathing in the smoke of others (called secondhand smoke or environmental tobacco smoke) can increase your risk of

developing lung cancer by almost 30%. Secondhand smoke is thought to cause more than 7,000 deaths from lung cancer each year.

Some evidence suggests that certain people are more susceptible to the cancer-causing effect of tobacco smoke than others.

If you or someone you care about needs help in quitting, see our document *Guide to Quitting Smoking* or call the American Cancer Society at 1-800-227-2345.

Radon

Radon is a naturally occurring radioactive gas that forms from the breakdown of uranium in soil and rocks. It cannot be seen, tasted, or smelled. According to the US Environmental Protection Agency (EPA), radon is the second leading cause of lung cancer, and is the leading cause among non-smokers.

Outdoors, there is so little radon that it is not likely to be dangerous. But indoors, radon can be more concentrated. When it is breathed in, it enters the lungs, exposing them to small amounts of radiation. This may increase a person's risk of lung cancer.

The lung cancer risk from radon is much lower than that from tobacco smoke. However, the risk from radon is much higher for people who smoke than for those who don't.

Radon levels in the soil vary across the country, but they can be high almost anywhere. Homes in some parts of the United States built on soil with natural uranium deposits can have high indoor radon levels (especially in basements). Studies from these areas have found that the risk of lung cancer is higher in those who have lived for many years in a radon-contaminated house.

If you are concerned about radon exposure, you can use a radon detection kit to test the levels in your home. State and local offices of the EPA can also give you the names of reliable companies that can test your home (or other buildings) for radon and help you fix the problem, if needed. For more information, see our document *Radon*.

Asbestos

Workplace exposure to asbestos fibers is an important risk factor for lung cancer. Studies have found that people who work with asbestos (in some mines, mills, textile plants, places where insulation is used, shipyards, etc.) are several times more likely to die of lung cancer. In workers exposed to asbestos who also smoke, the lung cancer risk is much greater than even adding the risks from these exposures separately. It's not clear to what extent low-level or short-term exposure to asbestos might raise lung cancer risk.

Both smokers and non-smokers exposed to asbestos also have a greater risk of developing mesothelioma, a type of cancer that starts in the pleura (the lining surrounding

the lungs). Because it is not usually considered a type of lung cancer, mesothelioma is discussed in our document *Malignant Mesothelioma*.

In recent years, government regulations have greatly reduced the use of asbestos in commercial and industrial products. It is still present in many homes and other older buildings, but it is not usually considered harmful as long as it is not released into the air by deterioration, demolition, or renovation. For more information, see our document *Asbestos*.

Other cancer-causing agents in the workplace

Other carcinogens (cancer-causing agents) found in some workplaces that can increase lung cancer risk include:

- Radioactive ores such as uranium
- Inhaled chemicals or minerals such as arsenic, beryllium, cadmium, silica, vinyl chloride, nickel compounds, chromium compounds, coal products, mustard gas, and chloromethyl ethers
- Diesel exhaust

The government and industry have taken steps in recent years to help protect workers from many of these exposures. But the dangers are still present, so if you work around these products, you should be careful to limit your exposure whenever possible.

Air pollution

In cities, air pollution (especially near heavily trafficked roads) appears to raise the risk of lung cancer slightly. This risk is far less than the risk caused by smoking, but some researchers estimate that worldwide about 5% of all deaths from lung cancer may be due to outdoor air pollution.

Radiation therapy to the lungs

People who have had radiation therapy to the chest for other cancers are at higher risk for lung cancer, particularly if they smoke; for example, people who have been treated for Hodgkin disease or women who get radiation to the chest after a mastectomy for breast cancer. Women who receive radiation therapy to the breast after a lumpectomy do not appear to have a higher than expected risk of lung cancer.

Arsenic in drinking water

Studies of people in parts of Southeast Asia and South America with high levels of arsenic in their drinking water have found a higher risk of lung cancer. In most of these studies, the levels of arsenic in the water were many times higher than those typically seen in the United States, even in areas where arsenic levels are above normal. For most Americans who are on public water systems, drinking water is not a major source of arsenic.

Personal or family history of lung cancer

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, especially if the relative was diagnosed at a younger age. It is not clear how much of this risk might be due to genetics and how much might be from shared household exposures (such as tobacco smoke or radon).

Researchers have found that genetics does seem to play a role in some families with a strong history of lung cancer. For example, people who inherit certain DNA changes in a particular chromosome (chromosome 6) are more likely to develop lung cancer, even if they don't smoke or only smoke a little. At this time these DNA changes cannot be routinely tested for. Research is ongoing in this area.

Certain dietary supplements

Studies looking at the possible role of vitamin supplements in reducing lung cancer risk have not been promising so far. In fact, 2 large studies found that smokers who took beta carotene supplements actually had an increased risk of lung cancer. The results of these studies suggest that smokers should avoid taking beta carotene supplements.

Factors with uncertain or unproven effects on lung cancer risk

Marijuana smoke

There are some reasons to think that marijuana smoking might increase lung cancer risk. Marijuana smoke contains tar and many of same the cancer-causing substances that are in tobacco smoke. (Tar is the sticky, solid material that remains after burning, which is thought to contain most of the harmful substances in smoke.) Marijuana cigarettes (joints) are typically smoked all the way to the end, where tar content is the highest. Marijuana is also inhaled very deeply and the smoke is held in the lungs for a long time, which gives any cancer causing substances more opportunity to deposit in the lungs. And

because marijuana is often an illegal substance, it may not be possible to control what other substances it might contain.

But those who use marijuana tend to smoke fewer marijuana cigarettes in a day or week than the amount of tobacco consumed by cigarette smokers. For example, a light smoker may smoke half of a pack (10 cigarettes) a day, but 10 marijuana cigarettes in a day would be very heavy use of marijuana. In one study, most people who smoked marijuana did so 2 to 3 times per month. The lesser amount smoked would make it harder to see an impact on lung cancer risk.

It has been hard to study whether there is a link between marijuana and lung cancer because marijuana was illegal in many countries for so long and it is not easy to gather information about the use of illegal drugs. Also, in the studies that looked at past marijuana use in people who had lung cancer, most of the marijuana smokers also smoked cigarettes. This can make it hard to know how much of the risk is from tobacco and how much might be from marijuana. More research is needed to know the cancer risks from smoking marijuana.

Talc and talcum powder

Talc is a mineral that in its natural form may contain asbestos. Some studies have suggested that talc miners and millers might have a higher risk of lung cancer and other respiratory diseases because of their exposure to industrial grade talc. But other studies of talc miners have not found an increase in lung cancer rate.

Talcum powder is made from talc. By law since 1973, all home-use talcum products (baby, body, and facial powders) in the United States have been asbestos-free. The use of cosmetic talcum powder has not been found to increase the risk of lung cancer.

Do we know what causes small cell lung cancer?

We don’t know what causes each case of lung cancer. But we do know many of the risk factors for these cancers (see “What are the risk factors for small cell lung cancer?”) and how some of them cause cells to become cancerous.

Smoking

Tobacco smoking is by far the leading cause of small cell lung cancer. Most deaths due to small cell lung cancer are caused by smoking or exposure to secondhand smoke.

Smoking is clearly the strongest risk factor for lung cancer, but it often interacts with other factors. Smokers exposed to other known risk factors such as radon and asbestos

are at even higher risk. Not everyone who smokes gets lung cancer, so other factors like genetics probably play a role as well (see below).

Lung cancer in non-smokers

It is rare for someone who has never smoked to be diagnosed with small cell lung cancer, but it can happen. Lung cancer in non-smokers can be caused by exposure to radon, secondhand smoke, air pollution, or other factors. Workplace exposures to asbestos, diesel exhaust, or certain other chemicals can also cause lung cancers in some people who do not smoke.

A small portion of lung cancers occur in people with no known risk factors for the disease. Some of these might just be random events that don't have an outside cause, but others might be due to factors that we don't yet know about.

Gene changes that may lead to lung cancer

Scientists now know how some of the risk factors for lung cancer can cause certain changes in the DNA of lung cells. These changes can lead to abnormal cell growth and, sometimes, cancer. DNA is the chemical in each of our cells that makes up our genes – the instructions for how our cells function. We usually look like our parents because they are the source of our DNA. But DNA affects more than how we look. It also can influence our risk for developing certain diseases, such as some kinds of cancer.

Some genes contain instructions for controlling when cells grow, divide into new cells, and die. Genes that help cells grow, divide, or stay alive are called *oncogenes*. Genes that slow down cell division or cause cells to die at the right time are called *tumor suppressor genes*. Cancers can be caused by DNA changes that turn on oncogenes or turn off tumor suppressor genes.

Inherited gene changes

Some people inherit DNA mutations (changes) from their parents that greatly increase their risk for developing certain cancers. But inherited mutations alone are not thought to cause very many lung cancers.

Still, genes do seem to play a role in some families with a history of lung cancer. For example, some people seem to inherit a reduced ability to break down or get rid of certain types of cancer-causing chemicals in the body, such as those found in tobacco smoke. This could put them at higher risk for lung cancer.

Other people may inherit faulty DNA repair mechanisms that make it more likely they will end up with DNA changes. Every time a cell divides into 2 new cells, it must make a new copy of its DNA. This process is not perfect, and copying errors sometimes occur. Cells normally have repair enzymes that proofread the DNA to help prevent this. People

with repair enzymes that don't work as well might be especially vulnerable to cancer-causing chemicals and radiation.

Researchers are developing tests that may help identify such people, but these tests are not yet used routinely. For now, doctors recommend that all people avoid tobacco smoke and other exposures that might increase their cancer risk.

Acquired gene changes

Gene changes related to lung cancer are usually acquired during life rather than inherited. Acquired mutations in lung cells often result from exposure to factors in the environment, such as cancer-causing chemicals in tobacco smoke. But some gene changes may just be random events that sometimes happen inside a cell, without having an outside cause.

Acquired changes in certain genes, such as the *TP53* and *RB1* tumor suppressor genes, are thought to be important in the development of small cell lung cancer. Changes in these and other genes may also make some lung cancers more likely to grow and spread than others. Not all lung cancers share the same gene changes, so there are undoubtedly changes in other genes that have not yet been found.

Can small cell lung cancer be prevented?

Not all lung cancers can be prevented, but there are some ways you can reduce your risk of getting lung cancer.

The best way to reduce your risk of lung cancer is not to smoke and to avoid breathing in other people's smoke.

If you stop smoking before a cancer develops, your damaged lung tissue gradually starts to repair itself. No matter what your age or how long you've smoked, quitting may lower your risk of lung cancer and help you live longer. People who stop smoking before age 50 cut their risk of dying in the next 15 years in half compared with those who continue to smoke. If you would like help quitting smoking, see our document *Guide to Quitting Smoking* or call the American Cancer Society at 1-800-227-2345.

Radon is an important cause of lung cancer. You can reduce your exposure to radon by having your home tested and treated, if needed. For more information, see our document *Radon*.

It is also helpful to avoid being exposed to known cancer-causing chemicals, in the workplace and elsewhere (see "What are the risk factors for small cell lung cancer?"). People working where these exposures are common should try to keep exposure to a minimum when possible.

A healthy diet with lots of fruits and vegetables may also help reduce your risk of lung cancer. Some evidence suggests that a diet high in fruits and vegetables may help protect

against lung cancer in both smokers and non-smokers. But any positive effect of fruits and vegetables on lung cancer risk would be much less than the increased risk from smoking.

Attempts to reduce the risk of lung cancer in current or former smokers by giving them high doses of vitamins or vitamin-like drugs have not been successful so far. In fact, some studies have found that beta-carotene, a nutrient related to vitamin A, appears to increase the rate of lung cancer in these people.

Some people who get lung cancer do not have any clear risk factors. Although we know how to prevent most lung cancers, at this time we don't know how to prevent all of them.

Can small cell lung cancer be found early?

Usually symptoms of lung cancer do not appear until the disease is already in an advanced stage, when it is very hard to cure. Even when symptoms of lung cancer do appear, many people may mistake them for other problems, such as an infection or long-term effects from smoking. This may delay the diagnosis.

Some lung cancers are diagnosed early because they are found by accident as a result of tests for other medical conditions. For example, lung cancer may be found by imaging tests (such as a chest x-ray or chest CT scan), bronchoscopy (viewing the inside of lung airways through a flexible lighted tube), or sputum cytology (microscopic examination of cells in coughed up phlegm) done for other reasons in patients with heart disease, pneumonia, or other lung conditions. A small portion of these patients do very well and may be cured of lung cancer.

Screening is the use of tests or exams to detect a disease in people without symptoms of that disease. Doctors have looked for many years for a test that could find lung cancer early and help people live longer, but only in recent years has a study shown that a lung cancer screening test can help lower the risk of dying from this disease. Still, small cell lung cancer tends to spread very early, so most lung cancers that are found before they have spread are the non-small cell type.

The National Lung Screening Trial

The National Lung Screening Trial (NLST) was a large clinical trial that looked at using a type of CT scan known as low-dose CT (sometimes called low-dose spiral or helical CT) to screen for lung cancer. CT scans of the chest provide more detailed pictures than chest x-rays and are better at finding small abnormalities in the lungs (discussed in more detail in the next section). Low-dose CT (LDCT) of the chest uses lower amounts of radiation than a standard chest CT and does not require the use of intravenous (IV) contrast dye.

The NLST compared LDCT of the chest to chest x-rays in people at high risk of lung cancer to see if these scans could help lower the risk of dying from lung cancer. The study included more than 50,000 people aged 55 to 74 who were current or former smokers and were in fairly good health. To be on the study, they had to have at least a 30 pack-year history of smoking. A pack-year is the number of cigarette packs smoked each day multiplied by the number of years a person has smoked. Someone who smoked a pack of cigarettes per day for 30 years has a 30 pack-year smoking history, as does someone who smoked 2 packs a day for 10 years and then a pack a day for another 10 years. Former smokers could enter the study if they had quit within the past 15 years. The study did not include people who had a prior history of lung cancer or lung cancer symptoms, if they had part of a lung removed, if they needed to be on oxygen at home to help them breathe, or if they had other serious medical problems.

People in the study got either 3 LDCT scans or 3 chest x-rays, each a year apart, to look for abnormal areas in the lungs that might be cancer. After several years, the study found that people who got LDCT had a 16% lower chance of dying from lung cancer than those who got chest x-rays. Overall, they were 7% less likely to die from any cause than those who got chest x-rays.

Screening with LDCT is also known to have some downsides that need to be considered. One drawback of this test is that it also finds a lot of abnormalities that have to be checked out with more tests, but turn out not to be cancer. (About 1 out of 4 people in the NLST had such a finding.) This may lead to additional tests such as other CT scans or more invasive tests such as needle biopsies or even surgery to remove a portion of lung in some people. These tests can sometimes lead to complications (like a collapsed lung) or rarely, death, even in people who do not have cancer (or who have very early stage cancer).

LDCT scans also expose people to a small amount of radiation with each test. It is less than the dose from a standard CT, but it is more than the dose from a chest x-ray. Some people who are screened may end up needing further CT scans, which means more radiation. When done in tens of thousands of people, this radiation may cause a few people to develop breast, lung, or thyroid cancers later on.

The NLST was a large study, but it left some questions that still need to be answered. For example, it’s not clear if screening with LDCT scans would have the same effect on people different than those allowed in the study, such as those who smoke less (or not at all) or people younger than age 55 or older than 74. Also, in the NLST, patients got a total of 3 scans over 2 years. It’s not yet clear what the effect would be if people were screened for longer than 2 years. Plus, the lung cancers that were found early were mainly of the non-small cell type, so it is not yet clear how helpful this test is in finding small cell lung cancer early.

These factors, and others, need to be taken into account by people and their doctors who are considering whether or not screening with LDCT scans is right for them.

American Cancer Society's guidelines for lung cancer screening

The American Cancer Society has thoroughly reviewed the subject of lung cancer screening and issued guidelines that are aimed at doctors and other health care providers:

Patients should be asked about their smoking history. Patients who meet ALL of the following criteria may be candidates for lung cancer screening:

- 55 to 74 years old
- In fairly good health (discussed further down)
- Have at least a 30 pack-year smoking history (this was discussed above)
- Are either still smoking or have quit smoking within the last 15 years

These criteria were based on what was used in the NLST.

Doctors should talk to these patients about the benefits, limitations, and potential harms of lung cancer screening. Screening should only be done at facilities that have the right type of CT scan and that have a great deal of experience in LDCT scans for lung cancer screening. The facility should also have a team of specialists that can provide the appropriate care and follow-up of patients with abnormal results on the scans.

For patients

If you fit all of the criteria for lung cancer screening listed above, you and your doctor (or other health care provider) should talk about starting screening. He or she will talk to you about what you can expect from screening, including possible benefits and harms, as well as the limitations of screening.

The main benefit is a lower chance of dying of lung cancer, which accounts for many deaths in current and former smokers. Still, it is important to be aware that, like with any type of screening, not everyone who gets screened will benefit. Screening with LDCT will not find all lung cancers, and not all of the cancers that are found will be found early. Even if a cancer is found by screening, you may still die from lung cancer. Also, LDCT often finds things that turn out not to be cancer, but have to be checked out with more tests to know what they are. This can mean more CT scans, or even invasive tests such as a lung biopsy, in which a piece of lung tissue is removed with a needle or in surgery. These tests have risks of their own (see above).

At this time, government and private insurance programs are not likely to provide coverage for a LDCT done for lung cancer screening.

Screening should only be done at facilities that have the right type of CT scanner and that have a great deal of experience in LD CT scans for lung cancer screening. The facility

should also have a team of specialists that can provide the appropriate care and follow-up of patients with abnormal results on the scans. You might not have the right kind of facility nearby, so you may need to travel some distance to be screened.

If you and your doctor decide that you should be screened, you should get a LDCT every year until you reach the age of 74, as long as you remain in good health.

If you are a current smoker, you should receive counseling about stopping. You should be told about your risk of lung cancer and referred to a smoking cessation program. Screening is not a good alternative to stopping smoking. For help quitting smoking, see our document *Guide to Quitting Smoking* or call the American Cancer Society at 1-800-227-2345.

What does “in fairly good health” mean?

Screening is meant to find cancer in people who do not have symptoms of the disease. People who already have symptoms that might be caused by lung cancer may need tests such as CT scans to find the underlying cause, which in some cases may be cancer. But this kind of testing is for diagnosis and is not the same as screening. Some of the possible symptoms of lung cancer that kept people out of the NLST were coughing up blood and weight loss without trying.

To get the most potential benefit from screening, patients need to be in good health. For example, they need to be able to have surgery and other treatments to try to cure lung cancer if it is found. Patients who require home oxygen therapy most likely could not withstand having part of a lung removed, and so are not candidates for screening. Patients with other serious medical problems that would shorten their lives or keep them from having surgery may also not be able to benefit enough from screening for it to be worth the risks, and so should also not be screened.

Metal implants in the chest (like pacemakers) or back (like rods in the spine) can interfere with x-rays and lead to poor quality CT images of the lungs. People with these types of implants were also kept out of the NLST, and so should not be screened with CT scans for lung cancer according to the ACS guidelines.

People who have been treated for lung cancer often have follow-up tests, including CT scans to see if the cancer has come back or spread. This is called surveillance and is not the same as screening. (People with a prior history of lung cancer were not eligible for the NLST.)

Signs and symptoms of small cell lung cancer

Most lung cancers do not cause any symptoms until they have spread too far to be cured, but some people with early lung cancer do have symptoms. If you go to your doctor when you first notice symptoms, your cancer might be diagnosed at an earlier stage, when treatment is more likely to be effective. The most common symptoms of lung cancer are:

- A cough that does not go away or gets worse
- Chest pain that is often worse with deep breathing, coughing, or laughing
- Hoarseness
- Weight loss and loss of appetite
- Coughing up blood or rust-colored sputum (spit or phlegm)
- Shortness of breath
- Feeling tired or weak
- Infections such as bronchitis and pneumonia that don’t go away or keep coming back
- New onset of wheezing

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

- Bone pain (like pain in the back or hips)
- Neurologic changes (such as headache, weakness or numbness of an arm or leg, dizziness, balance problems, or seizures), from cancer spread to the brain
- Yellowing of the skin and eyes (jaundice), from cancer spread to the liver
- Lumps near the surface of the body, due to cancer spreading to the skin or to lymph nodes (collection of immune system cells) such as those in the neck or above the collarbone

Most of the symptoms listed above are more likely to be caused by conditions other than lung cancer. Still, if you have any of these problems, it’s important to see your doctor right away so the cause can be found and treated, if needed.

Some lung cancers can cause a group of specific symptoms. These are often described as *syndromes*.

Horner syndrome

Cancers of the upper part of the lungs (sometimes called *Pancoast tumors*) may damage a nerve that passes from the upper chest into your neck. This can cause severe shoulder pain. Sometimes these tumors also cause a group of symptoms called *Horner syndrome*:

- Drooping or weakness of one eyelid
- Having a smaller pupil (dark part in the center of the eye) in the same eye
- Reduced or absent sweating on the same side of the face

Conditions other than lung cancer can also cause Horner syndrome.

Superior vena cava syndrome

The superior vena cava (SVC) is a large vein that carries blood from the head and arms back to the heart. It passes next to the upper part of the right lung and the lymph nodes inside the chest. Tumors in this area may push on the SVC, which can cause the blood to back up in the veins. This can cause swelling in the face, neck, arms, and upper chest (sometimes with a bluish-red skin color). It can also cause headaches, dizziness, and a change in consciousness if it affects the brain. While SVC syndrome can develop gradually over time, in some cases it can become life-threatening, and needs to be treated right away.

Paraneoplastic syndromes

Some lung cancers can make hormone-like 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 syndromes*. Sometimes these syndromes may be the first symptoms of lung cancer. Because the symptoms affect other organs, patients and their doctors may first suspect that a disease other than lung cancer is causing them.

Some of the more common paraneoplastic syndromes associated with small cell lung cancer (SCLC) are:

SIADH (syndrome of inappropriate anti-diuretic hormone): In this condition, the cancer cells make a hormone (ADH) that causes the kidneys to retain water. This causes salt levels in the blood to become very low. Symptoms of SIADH can include fatigue, loss of appetite, muscle weakness or cramps, nausea, vomiting, restlessness, and confusion. Without treatment, severe cases may lead to seizures and coma.

Cushing syndrome: In some cases, lung cancer cells may make ACTH, a hormone that causes the adrenal glands to secrete cortisol. This can lead to symptoms such as weight

gain, easy bruising, weakness, drowsiness, and fluid retention. Cushing syndrome can also cause high blood pressure and high blood sugar levels, or even diabetes.

Neurologic problems: Small cell lung cancer can sometimes cause the body's immune system to attack parts of the nervous system, which can lead to problems. One example is a muscle disorder called the *Lambert-Eaton syndrome*. In this syndrome, muscles around the hips become weak. One of the first signs may be trouble getting up from a sitting position. Later, muscles around the shoulder may become weak. A rarer problem is *paraneoplastic cerebellar degeneration*, which can cause loss of balance and unsteadiness in arm and leg movement, as well as trouble speaking or swallowing. SCLC can also cause other nervous system problems, such as muscle weakness, sensation changes, vision problems, or even changes in behavior.

Again, many of the symptoms listed above can also be caused by conditions other than lung cancer. Still, if you have any of these problems, it's important to see your doctor right away so the cause can be found and treated, if needed.

How is small cell lung cancer diagnosed?

Lung cancers can be found by screening, but most lung cancers are found because they are causing problems. If you are having signs or symptoms of lung cancer, you should see your doctor, who will examine you and order some tests. The actual diagnosis is of lung cancer is made by looking at a sample of lung cells under a microscope.

Medical history and physical exam

If you have signs or symptoms that suggest you might have lung cancer, your doctor will want to take a medical history to check for risk factors and learn more about your symptoms. Your doctor will also examine you to look for signs of lung cancer and other health problems.

If the results of the history and physical exam suggest you might have lung cancer, more involved tests will be done. These could include imaging tests and/or getting biopsies of lung tissue.

Imaging tests

Imaging tests use x-rays, magnetic fields, sound waves, or radioactive substances to create pictures of the inside of your body. Imaging tests may be done for a number of reasons both before and after a diagnosis of lung cancer, including:

- To help find a suspicious area that might be cancerous
- To learn how far cancer may have spread

- To help determine if treatment has been effective
- To look for possible signs of cancer coming back after treatment

Chest x-ray

This is often the first test your doctor will do to look for any masses or spots on the lungs. Plain x-rays of your chest can be done at imaging centers, hospitals, and even in some doctors' offices. If the x-ray is normal, you probably don't have lung cancer (although some lung cancers may not show up on an x-ray). If something suspicious is seen, your doctor may order more tests.

Computed tomography (CT) scan

A CT (or CAT) scan is more likely to show lung tumors than routine chest x-rays. A CT scan can also provide precise information about the size, shape, and position of any lung tumors and can help find enlarged lymph nodes that might contain cancer that has spread from the lung. Most people with SCLC will get a CT of the chest and abdomen to look at the lungs and lymph nodes, and to look for masses in the adrenal glands, liver, and other internal organs that may be affected by the spread of lung cancer. Some people will get a CT of the brain to look for cancer spread, but an MRI is more likely to be used when looking at the brain.

The CT scan uses x-rays to produce 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 detailed images of the soft tissues in the body.

Before the CT scan, you may be asked to drink a contrast solution or you may get an injection of a contrast solution through an IV (intravenous). This helps better outline structures in your body. 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 any allergies or if you ever had a reaction to any contrast material used for x-rays.

A CT scanner has been described as a large donut, with a narrow table that slides in and out of the middle opening. You will need to lie still on the table while the scan is being done. CT scans take longer than regular x-rays, and you might feel a bit confined by the ring while the pictures are being taken.

CT guided needle biopsy: If a suspected area of cancer lies deep within the body, a CT scan can be used to guide a biopsy needle precisely into the suspected area. For this procedure, you stay on the CT scanning table, while the doctor advances a biopsy needle

through the skin and toward the mass. CT scans are repeated until the doctor can see that the needle is within the mass. A biopsy sample is then removed and looked at under a microscope.

Magnetic resonance imaging (MRI) scan

Most patients with SCLC will have an MRI scan of the brain to look for possible cancer spread, although a CT scan may be used instead. MRI may also be used to look for possible spread to the spinal cord if the patients have certain symptoms.

Like CT scans, MRI scans provide detailed images of soft tissues in the body. But MRI scans use radio waves and strong magnets instead of x-rays. The energy from the radio waves is absorbed and then released in a pattern formed by the type of 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 take longer than CT scans (often up to an hour) and are a little more uncomfortable. You have to lie inside a narrow tube, which is confining and can upset people with a fear of enclosed spaces. Special, “open” MRI machines can sometimes help with this if needed, but the images may not be as sharp in some cases. MRI machines make buzzing and clicking noises, so some centers provide earplugs to help block this noise out.

Positron emission tomography (PET) scan

A PET scan can be a very important test if you appear to have early stage (or *limited*) SCLC. Your doctor can use this test to see if the cancer has spread to lymph nodes or other organs, which can help determine your treatment options. A PET scan can also be helpful in getting a better idea whether an abnormal area on a chest x-ray or CT scan might be cancer.

PET scans are also useful if your doctor thinks the cancer may have spread but doesn't know where. It can reveal spread of cancer to the liver, bones, adrenal glands, or some other organs. It is not as useful for looking at the brain, since all brain cells use a lot of glucose.

For this test, a form of radioactive sugar (known as fluorodeoxyglucose or FDG) is injected into the blood. (The amount of radioactivity used is very low and will pass out of the body over the next day or so.) Because cancer cells in the body are growing rapidly, they absorb more of the radioactive sugar. After about an hour, you will be moved onto a table in the PET scanner. You lie on the table for about 30 minutes while a special camera creates a picture of areas of radioactivity in the body. The picture is not finely detailed like a CT or MRI scan, but it provides helpful information about your whole body.

Often a PET scan is combined with a CT scan using a special machine that can do both scans at the same time. This lets the doctor compare areas of higher radioactivity on the PET with the more detailed appearance of that area on the CT. For people with SCLC, PET/CT scans are used more often than PET scans alone.

Bone scan

A bone scan can help show if a cancer has spread to the bones.

For this test, a small amount of low-level radioactive material is injected into a vein (intravenously, or IV). The substance settles in areas of bone changes throughout the entire skeleton over the course of a couple of hours. You then lie on a table for about 30 minutes while a special camera detects the radioactivity and creates a picture of your skeleton.

Areas of active bone changes attract the radioactivity and show up as “hot spots.” These areas may suggest metastatic cancer, but arthritis or other bone diseases can also cause the same pattern. To distinguish among these conditions, your cancer care team may use other imaging tests such as plain x-rays or MRI scans to get a better look at the areas that light up, or they may even take biopsy samples of the bone.

Bone scans are done mainly when there is reason to think the cancer may have spread to the bones (because of symptoms such as bone pain) and other test results aren’t clear. PET scans can usually show the spread of cancer to bones, so bone scans aren’t usually needed if a PET scan has already been done.

Tests to diagnose lung cancer

Symptoms and the results of imaging tests may strongly suggest that a person has lung cancer, but the actual diagnosis of lung cancer is made by looking at lung cells under a microscope.

The cells can be taken from lung secretions (sputum or phlegm), found in fluid removed from the area around the lung (*thoracentesis*), or removed from a suspicious area (*biopsy*). One or more of the tests below may be used to find out if a lung mass seen on imaging tests is indeed lung cancer. These tests can also be used to tell the exact type of lung cancer you have and to help determine how far it may have spread. The choice of which test(s) to use depends on the situation.

Sputum cytology

For this test, a sample of sputum (mucus you cough up from the lungs) is looked at under a microscope to see if it contains cancer cells. The best way to do this is to get early morning samples from you 3 days in a row. This test is more likely to help find cancers that start in the major airways of the lung, such as most small cell lung cancers and

squamous cell lung cancers. It may not be as helpful for finding other types of lung cancer.

Thoracentesis

If there is a buildup of fluid around the lungs (pleural effusion), doctors can use thoracentesis to relieve symptoms and to see if it was caused by cancer spreading to the lining of the lungs (pleura). The buildup might also be caused by other conditions, such as heart failure or an infection.

For this procedure, the skin is numbed and a hollow needle is inserted between the ribs to drain the fluid. (In a similar test called *pericardiocentesis*, fluid is removed from within the sac around the heart.) The fluid is checked under a microscope to look for cancer cells. Chemical tests of the fluid are also sometimes useful in telling a malignant (cancerous) pleural effusion from a benign (non-cancerous) one.

If a malignant pleural effusion has been diagnosed, thoracentesis may be repeated to remove more fluid. Fluid buildup can keep the lungs from filling with air, so thoracentesis can help the patient breathe better.

Needle biopsy

Doctors can often use a hollow needle to get a small sample from a suspicious area (mass). An advantage of needle biopsies is that they don't require a surgical incision, but in some cases they might not provide enough of a sample to make a diagnosis.

In a *fine needle aspiration (FNA)* biopsy, the doctor uses a syringe with a very thin, hollow needle (thinner than the ones used for blood tests) to withdraw (aspirate) cells and small fragments of tissue. In a *core biopsy*, a larger needle is used to remove one or more small cylinders (cores) of tissue. Core biopsies provide a larger sample than FNA biopsies and so are often preferred for lung tumors.

If the suspected tumor is in the outer portion of the lungs, either kind of biopsy needle can be inserted through the skin on the chest wall. This is called a *transthoracic needle biopsy*. The area where the needle is to be inserted may be numbed with local anesthesia first. The doctor then guides the needle into the area while looking at the lungs with either fluoroscopy (which is like an x-ray, but the image is shown on a screen rather than on film) or CT scans. Unlike fluoroscopy, CT doesn't give a constant picture, so the needle is inserted toward the mass, a CT image is taken, and the direction of the needle is guided based on the image. This is repeated a few times until the needle is within the mass.

A possible complication of this procedure is that air may leak out of the lung at the biopsy site and into the space between the lung and the chest wall. This can cause part of the lung to collapse and could cause trouble breathing. This complication, called a

pneumothorax, often gets better without any treatment. If not, it is treated by putting a small tube into the chest space and sucking out the air over a day or two, after which it usually heals on its own.

An FNA biopsy may also be done to check for cancer in the lymph nodes between the lungs:

- *Transtracheal FNA* or *transbronchial FNA* is done by passing the needle through the wall of the trachea (windpipe) or bronchi (the large airways leading into the lungs) during bronchoscopy or endobronchial ultrasound (described below).
- In some cases an FNA biopsy is done during endoscopic esophageal ultrasound (described below) by passing the needle through the wall of the esophagus.

Bronchoscopy

Bronchoscopy can help the doctor find some tumors or blockages in the larger airways of the lungs. It may be used to find a lung tumor or to take a sample of a tumor to see if it is cancer.

For this exam, a lighted, flexible fiber-optic tube (called a *bronchoscope*) is passed through the mouth or nose and down into the windpipe and bronchi. The mouth and throat are sprayed first with a numbing medicine. You may also be given medicine through an intravenous (IV) line to make you feel relaxed.

Small instruments can be passed down the bronchoscope to take biopsies (samples of tissue). The doctor can also sample cells from the lining of the airways with a small brush (bronchial brushing) or by rinsing the airways with sterile saltwater (bronchial washing). These tissue and cell samples are then looked at under a microscope.

Tests to find lung cancer spread

These tests may be done after cancer has been diagnosed to look for spread.

Endobronchial ultrasound

Ultrasound is a type of imaging test that uses sound waves to create pictures of the inside of your body. For this test, a small, microphone-like instrument called a transducer gives off sound waves and picks up the echoes as they bounce off body tissues. The echoes are converted by a computer into a black and white image on a computer screen.

For endobronchial ultrasound, a bronchoscope is fitted with an ultrasound transducer at its tip and is passed down into the windpipe. This is done with numbing medicine (local anesthesia) and light sedation.

The transducer can be pointed in different directions to look at lymph nodes and other structures in the mediastinum (the area between the lungs). If suspicious areas such as enlarged lymph nodes are seen on the ultrasound, a hollow needle can be passed through the bronchoscope to get biopsy samples of them. The samples are then sent to a lab to be looked at under a microscope.

This test may be used if the doctor is considering surgery as a part of treatment, which is not often the case for small cell lung cancer. It is used more often for non-small cell lung cancer.

Endoscopic esophageal ultrasound

This test is like endobronchial ultrasound, except the doctor passes an endoscope (a lighted, flexible scope) down the throat and into the esophagus (the tube connecting the throat to the stomach). This is done with numbing medicine (local anesthesia) and light sedation.

The esophagus lies just behind the windpipe and is close to some lymph nodes inside the chest to which lung cancer may spread. As with endobronchial ultrasound, the transducer can be pointed in different directions to look at lymph nodes and other structures inside the chest that might contain lung cancer. If enlarged lymph nodes are seen on the ultrasound, a hollow needle can be passed through the endoscope to get biopsy samples of them. The samples are then sent to a lab to be looked at under a microscope.

This test may be used if the doctor is considering surgery as a part of treatment, which is not often the case for small cell lung cancer. It is used more often for non-small cell lung cancer.

Mediastinoscopy and mediastinotomy

These procedures may be done to look more directly at and get samples from the structures in the mediastinum (the area between the lungs). They are done in an operating room while you are under general anesthesia (in a deep sleep). The main difference between the two is in the location and size of the incision.

These tests may be used if the doctor is considering surgery as a part of treatment, which is not often the case for small cell lung cancer. They are used more often for non-small cell lung cancer.

Mediastinoscopy: A small cut is made in the front of the neck and a thin, hollow, lighted tube is inserted behind the sternum (breast bone) and in front of the windpipe to look at the area. Instruments can be passed through this tube to take tissue samples from the lymph nodes along the windpipe and the major bronchial tube areas. Looking at the samples under a microscope can show whether cancer cells are present.

Mediastinotomy: The surgeon makes a slightly larger incision (usually about 2 inches long) between the second and third ribs next to the breast bone. This lets the surgeon reach some lymph nodes that cannot be reached by mediastinoscopy.

Thoracoscopy

This procedure can be done to find out if cancer has spread to the spaces between the lungs and the chest wall, or to the linings of these spaces (called *pleura*). It can also be used to sample tumors on the outer parts of the lungs as well as nearby lymph nodes and fluid, and to assess whether a tumor is growing into nearby tissues or organs. This procedure is not often done just to diagnose lung cancer, unless other tests such as needle biopsies are unable to get enough samples for the diagnosis.

Thoracoscopy is done in an operating room while you are under general anesthesia (in a deep sleep). A small cut (incision) is made in the side of the chest wall. (Sometimes more than one cut is made.) The doctor then inserts a thin, lighted tube with a small video camera on the end through the incision to view the space between the lungs and the chest wall. Using this, the doctor can see potential cancer deposits on the lining of the lung or chest wall and remove small pieces of the tissue to be looked at under the microscope. (When certain areas can't be reached with thoracoscopy, the surgeon may need to make a larger incision in the chest wall, known as a *thoracotomy*.)

Thoracoscopy can also be used as part of the treatment to remove part of a lung in some early-stage lung cancers. This type of operation, known as *video-assisted thoracic surgery* (VATS), is described in more detail in the "Surgery for small cell lung cancer" section.

Because surgery is not often part of the treatment of SCLC, this test isn't often needed.

Bone marrow aspiration and biopsy

These tests can be done to look for spread of the cancer into the bone marrow. Bone marrow is where new blood cells are made and is found inside certain bones.

The two tests are usually done at the same time. The samples are most often taken from the back of the pelvic (hip) bone.

In bone marrow *aspiration*, you lie on a table (either on your side or on your belly). The skin over the hip is cleaned. Then the skin and the surface of the bone are numbed with local anesthetic, which may cause a brief stinging or burning sensation. A thin, hollow needle is then inserted into the bone, and a syringe is used to suck out a small amount of liquid bone marrow (about 1 teaspoon). Even with the anesthetic, most people still have some brief pain when the marrow is removed.

A bone marrow *biopsy* is usually done just after the aspiration. A small piece of bone and marrow is removed with a slightly larger needle that is twisted as it is pushed down into

the bone. The biopsy will likely also cause some brief pain. Once the biopsy is done, pressure will be applied to the site to help stop any bleeding.

Bone marrow aspiration and biopsy are sometimes done in patients thought to have early (limited) stage small cell lung cancer but who have blood test results suggesting the cancer may have reached the bone marrow. In recent years, PET scans have been used more often for staging, so these tests are now rarely done for SCLC.

Lab tests of biopsy and other samples

Samples that have been collected during biopsies or other tests are sent to a pathology lab. A pathologist, a doctor who uses lab tests to diagnose diseases such as cancer, will look at the samples under a microscope and may do other special tests to help better classify the cancer. (Cancers from other organs can spread to the lungs. It's very important to find out where the cancer started, because treatment is different depending on the type of cancer.)

The results of these tests are described in a pathology report, which is usually available within about a week. If you have any questions about your pathology results or any diagnostic tests, talk to your doctor. If needed, you can get a second opinion of your pathology report by having your tissue samples sent to a pathologist at another lab recommended by your doctor.

For more information on understanding your pathology report, see the "Lung Pathology" section of our website.

Immunohistochemistry

For this test, very thin slices of the sample are attached to glass microscope slides. The samples are then treated with special proteins (antibodies) designed to attach only to a specific substance found in certain cancer cells. If the patient's cancer cells contain that substance, the antibody will attach to the cells. Chemicals are then added so that antibodies attached to the cells change color. The doctor who views the sample under a microscope can see this color change.

Blood tests

Blood tests are not used to diagnose lung cancer. But they can help to get a sense of a person's overall health (for example, to see if a person is healthy enough to have surgery) and to help tell if cancer may have spread to other areas.

A complete blood count (CBC) determines whether your blood has normal numbers of various cell types. For example, it can show if you are anemic (have a low number of red blood cells), if you could have trouble with bleeding (due to a low number of blood platelets), or if you are at increased risk for infections (due to a low number of white

blood cells). This test will be repeated regularly if you are treated with chemotherapy, because these drugs can affect blood-forming cells of the bone marrow.

Blood chemistry tests can help spot abnormalities in some of your organs, such as the liver or kidneys. For example, if cancer has spread to the bones, it may cause higher than normal levels of calcium and alkaline phosphatase.

Pulmonary function tests

Pulmonary function tests (PFTs) may be done after lung cancer is diagnosed to see how well your lungs are working. They are generally only needed if surgery might be an option in treating the cancer, which is rare in small cell lung cancer. Surgery to remove lung cancer may mean removing part or all of a lung, so it's important to know how well the lungs are working beforehand.

There are different types of PFTs, but they all basically involve having you breathe in and out through a tube that is connected to a machine that measures airflow.

How is small cell lung cancer staged?

The stage of a cancer describes how far it has spread. Your treatment and prognosis (outlook) depend, to a large extent, on the cancer's stage.

There are actually 2 types of staging for small cell lung cancer (SCLC).

- The *clinical stage* is based on the results of the physical exam, biopsies, and imaging tests (CT scan, chest x-ray, PET scan, etc.), which are described in the section "How is small cell lung cancer diagnosed?"
- If you have surgery, your doctor can also determine a *pathologic stage*, which is based on the same factors as the clinical stage, plus what is found as a result of the surgery.

The clinical and pathologic stages may be different in some cases. For example, during surgery the doctor may find cancer in an area that did not show up on imaging tests, which might give the cancer a more advanced pathologic stage.

Because most patients with SCLC do not have surgery, the clinical stage is most often used when describing the extent of this cancer. However, when it is available, the pathologic stage is likely to be more accurate than the clinical stage, as it uses the additional information obtained at surgery.

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. There are 2 staging systems that can be used to describe the extent of spread of SCLC.

Limited and extensive stage

For treatment purposes, most doctors use a 2-stage system that divides SCLC into limited stage and extensive stage.

Limited stage means that the cancer is only in one side of the chest and can be treated with a single radiation field. This can include one lung (unless tumors are widespread throughout the lung), as well as the lymph nodes on the same side of the chest. Lymph nodes above the collarbone (*clavicle*) can be affected in limited stage as long as they are on the same side of the chest as the cancer. Some doctors also include lymph nodes at the center of the chest (*mediastinal lymph nodes*) even when they are closer to the other side of the chest. What is important is that the cancer is confined to an area that is small enough to be treated with radiation therapy in one "port." In only about 1 out of 3 people with SCLC is the cancer limited stage when it is first found.

Extensive stage is used to describe cancers that have spread widely throughout the lung, to the other lung, to lymph nodes on the other side of the chest, or to distant organs (including the bone marrow). Many doctors consider SCLC that has spread to the fluid around the lung to be extensive stage as well. About 2 out of 3 people with SCLC have extensive disease when their cancer is first found.

SCLC is often staged in this way because it helps doctors decide if a patient might benefit from more aggressive treatments such as chemotherapy combined with radiation therapy to try to cure the cancer (limited stage), or whether chemotherapy alone is likely to be a better option (extensive stage).

The TNM staging system

A more formal system to describe the growth and spread of lung cancer is the American Joint Committee on Cancer (AJCC) **TNM** staging system. The TNM system is based on 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 spread of cancer to nearby (regional) lymph **nodes**. Lymph nodes are small bean-shaped collections of immune system cells to which cancers often spread before going to other parts of the body.
- **M** indicates whether the cancer has spread (**metastasized**) to other organs of the body. (The most common sites are the brain, bones, adrenal glands, liver, kidneys, and the other lung.)

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 TNM staging system is complex and can be hard for patients (and even some doctors) to understand. If you have any questions about the stage of your cancer, ask your doctor to explain it to you.

T categories for lung cancer

TX: The main (primary) tumor can't be assessed, or cancer cells were seen on sputum cytology or bronchial washing but no tumor can be found.

T0: There is no evidence of a primary tumor.

Tis: Cancer is found only in the top layers of cells lining the air passages. It has not grown into deeper lung tissues. This is also known as *carcinoma in situ*.

T1: The tumor is no larger than 3 centimeters (cm)—slightly less than 1¼ inches—across, has not reached the membranes that surround the lungs (visceral pleura), and does not affect the main branches of the bronchi.

If the tumor is 2 cm (about 4/5 of an inch) or less across, it is called **T1a**. If the tumor is larger than 2 cm but not larger than 3 cm across, it is called **T1b**.

T2: The tumor has 1 or more of the following features:

- It is larger than 3 cm across but not larger than 7 cm.
- It involves a main bronchus, but is not closer than 2 cm (about ¾ inch) to the carina (the point where the windpipe splits into the left and right main bronchi).
- It has grown into the membranes that surround the lungs (visceral pleura).
- The tumor partially clogs the airways, but this has not caused the entire lung to collapse or develop pneumonia.

If the tumor is 5 cm or less across, it is called **T2a**. If the tumor is larger than 5 cm across (but not larger than 7 cm), it is called **T2b**.

T3: The tumor has 1 or more of the following features:

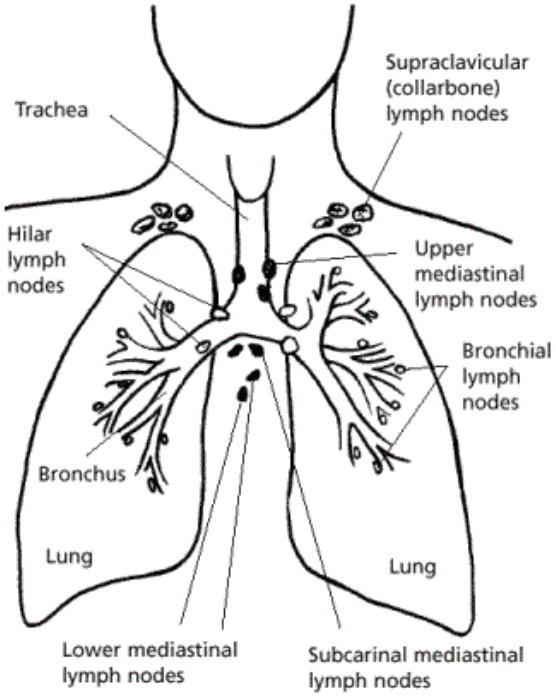
- It is larger than 7 cm across.
- It has grown into the chest wall, the breathing muscle that separates the chest from the abdomen (diaphragm), the membranes surrounding the space between the two lungs (mediastinal pleura), or membranes of the sac surrounding the heart (parietal pericardium).
- It invades a main bronchus and is closer than 2 cm (about ¾ inch) to the carina, but it does not involve the carina itself.

- It has grown into the airways enough to cause an entire lung to collapse or to cause pneumonia in the entire lung.
- Two or more separate tumor nodules are present in the same lobe of a lung

T4: The cancer has 1 or more of the following features:

- A tumor of any size has grown into the space between the lungs (mediastinum), the heart, the large blood vessels near the heart (such as the aorta), the windpipe (trachea), the tube connecting the throat to the stomach (esophagus), the backbone, or the carina.
- Two or more separate tumor nodules are present in different lobes of the same lung.

N categories for lung cancer



NX: Nearby lymph nodes cannot be assessed.

N0: There is no spread to nearby lymph nodes.

N1: The cancer has spread to lymph nodes within the lung and/or around the area where the bronchus enters the lung (hilar lymph nodes). Affected lymph nodes are on the same side as the primary tumor.

N2: The cancer has spread to lymph nodes around the carina (the point where the windpipe splits into the left and right bronchi) or in the space between the lungs (mediastinum). Affected lymph nodes are on the same side as the primary tumor.

N3: The cancer has spread to lymph nodes near the collarbone on either side, and/or spread to hilar or mediastinal lymph nodes on the side opposite the primary tumor.

M categories for lung cancer

M0: No spread to distant organs or areas. This includes the other lung, lymph nodes further away than those mentioned in the N stages above, and other organs or tissues such as the liver, bones, or brain.

M1a: Any of the following:

- The cancer has spread to the other lung
- Cancer cells are found in the fluid around the lung (called a *malignant pleural effusion*)
- Cancer cells are found in the fluid around the heart (called a *malignant pericardial effusion*)

M1b: The cancer has spread to distant lymph nodes or to other organs such as the liver, bones, or brain.

Stage grouping for lung cancer

Once the T, N, and M categories have been assigned, this information is combined to assign an overall stage of 0, I, II, III, or IV. This process is called *stage grouping*. Some stages are subdivided into A and B. The stages identify cancers that have a similar outlook (prognosis). Patients with lower stage numbers tend to have a better outlook.

Occult (hidden) cancer

TX, N0, M0: Cancer cells are seen in a sample of sputum or other lung fluids, but the cancer isn't found with other tests, so its location can't be determined.

Stage 0

Tis, N0, M0: The cancer is found only in the top layers of cells lining the air passages. It has not invaded deeper into other lung tissues and has not spread to lymph nodes or distant sites.

Stage IA

T1a/T1b, N0, M0: The cancer is no larger than 3 cm across, has not reached the membranes that surround the lungs, and does not affect the main branches of the bronchi. It has not spread to lymph nodes or distant sites.

Stage IB

T2a, N0, M0: The cancer has 1 or more of the following features:

- The main tumor is between larger than 3 cm across but not larger than 5 cm.
- The tumor has grown into a main bronchus, but is not within 2 cm of the carina (and it is not larger than 5 cm).
- The tumor has grown into the visceral pleura (the membranes surrounding the lungs) and is not larger than 5 cm.
- The tumor is partially clogging the airways (and is not larger than 5 cm).

The cancer has not spread to lymph nodes or distant sites.

Stage IIA

There are 3 main combinations of categories that make up this stage.

T1a/T1b, N1, M0: The cancer is no larger than 3 cm across, has not grown into the membranes that surround the lungs, and does not affect the main branches of the bronchi. It has spread to lymph nodes within the lung and/or around the area where the bronchus enters the lung (hilar lymph nodes). These lymph nodes are on the same side as the cancer. It has not spread to distant sites.

OR

T2a, N1, M0: The cancer has 1 or more of the following features:

- The main tumor is larger than 3 cm across but not larger than 5 cm.
- The tumor has grown into a main bronchus, but is not within 2 cm of the carina (and it is not larger than 5 cm).
- The tumor has grown into the visceral pleura (the membranes surrounding the lungs) and is not larger than 5 cm.
- The tumor is partially clogging the airways (and is not larger than 5 cm).

The cancer has also spread to lymph nodes within the lung and/or around the area where the bronchus enters the lung (hilar lymph nodes). These lymph nodes are on the same side as the cancer. It has not spread to distant sites.

OR

T2b, N0, M0: The cancer has 1 or more of the following features:

- The main tumor is larger than 5 cm across but not larger than 7 cm.
- The tumor has grown into a main bronchus, but is not within 2 cm of the carina (and it is between 5 and 7 cm across).
- The tumor has grown into the visceral pleura (the membranes surrounding the lungs) and is between 5 and 7 cm across.
- The tumor is partially clogging the airways (and is between 5 and 7 cm across).

The cancer has not spread to lymph nodes or distant sites.

Stage IIB

There are 2 combinations of categories that make up this stage.

T2b, N1, M0: The cancer has 1 or more of the following features:

- The main tumor is larger than 5 cm across but not larger than 7 cm.
- The tumor has grown into a main bronchus, but is not within 2 cm of the carina (and it is between 5 and 7 cm across).
- The tumor has grown into the visceral pleura (the membranes surrounding the lungs) and is between 5 and 7 cm across.
- The cancer is partially clogging the airways (and is between 5 and 7 cm across).

It has also spread to lymph nodes within the lung and/or around the area where the bronchus enters the lung (hilar lymph nodes). These lymph nodes are on the same side as the cancer. It has not spread to distant sites.

OR

T3, N0, M0: The main tumor has 1 or more of the following features:

- It is larger than 7 cm across.
- It has grown into the chest wall, the breathing muscle that separates the chest from the abdomen (diaphragm), the membranes surrounding the space between the lungs (mediastinal pleura), or membranes of the sac surrounding the heart (parietal pericardium).
- It invades a main bronchus and is closer than 2 cm (about ¾ inch) to the carina, but it does not involve the carina itself.
- It has grown into the airways enough to cause an entire lung to collapse or to cause pneumonia in the entire lung.

- Two or more separate tumor nodules are present in the same lobe of a lung.

The cancer has not spread to lymph nodes or distant sites.

Stage IIIA

There are 3 main combinations of categories that make up this stage.

T1 to T3, N2, M0: The main tumor can be any size. It has **not** grown into the space between the lungs (mediastinum), the heart, the large blood vessels near the heart (such as the aorta), the windpipe (trachea), the tube connecting the throat to the stomach (esophagus), the backbone, or the carina. It has not spread to different lobes of the same lung.

The cancer has spread to lymph nodes around the carina (the point where the windpipe splits into the left and right bronchi) or in the space between the lungs (mediastinum). These lymph nodes are on the same side as the main lung tumor. The cancer has not spread to distant sites.

OR

T3, N1, M0: The cancer has 1 or more of the following features:

- It is larger than 7 cm across.
- It has grown into the chest wall, the breathing muscle that separates the chest from the abdomen (diaphragm), the membranes surrounding the space between the lungs (mediastinal pleura), or membranes of the sac surrounding the heart (parietal pericardium).
- It invades a main bronchus and is closer than 2 cm to the carina, but it does not involve the carina itself.
- Two or more separate tumor nodules are present in the same lobe of a lung
- It has grown into the airways enough to cause an entire lung to collapse or to cause pneumonia in the entire lung.

The cancer has also spread to lymph nodes within the lung and/or around the area where the bronchus enters the lung (hilar lymph nodes). These lymph nodes are on the same side as the cancer. It has not spread to distant sites.

OR

T4, N0 or N1, M0: The cancer has 1 or more of the following features:

- A tumor of any size has grown into the space between the lungs (mediastinum), the heart, the large blood vessels near the heart (such as the aorta), the windpipe

(trachea), the tube connecting the throat to the stomach (esophagus), the backbone, or the carina.

- Two or more separate tumor nodules are present in different lobes of the same lung.

It may or may not have spread to lymph nodes within the lung and/or around the area where the bronchus enters the lung (hilar lymph nodes). Any affected lymph nodes are on the same side as the cancer. It has not spread to distant sites.

Stage IIIB

There are 2 combinations of categories that make up this stage.

Any T, N3, M0: The cancer can be of any size. It may or may not have grown into nearby structures or caused pneumonia or lung collapse. It has spread to lymph nodes near the collarbone on either side, and/or has spread to hilar or mediastinal lymph nodes on the side opposite the primary tumor. The cancer has not spread to distant sites.

OR

T4, N2, M0: The cancer has 1 or more of the following features:

- A tumor of any size has grown into the space between the lungs (mediastinum), the heart, the large blood vessels near the heart (such as the aorta), the windpipe (trachea), the tube connecting the throat to the stomach (esophagus), the backbone, or the carina.

- Two or more separate tumor nodules are present in different lobes of the same lung.

The cancer has also spread to lymph nodes around the carina (the point where the windpipe splits into the left and right bronchi) or in the space between the lungs (mediastinum). Affected lymph nodes are on the same side as the main lung tumor. It has not spread to distant sites.

Stage IV

There are 2 combinations of categories that make up this stage.

Any T, any N, M1a: The cancer can be any size and may or may not have grown into nearby structures or reached nearby lymph nodes. In addition, any of the following is true:

- The cancer has spread to the other lung

- Cancer cells are found in the fluid around the lung (called a *malignant pleural effusion*)

- Cancer cells are found in the fluid around the heart (called a *malignant pericardial effusion*)

OR

Any T, any N, M1b: The cancer can be any size and may or may not have grown into nearby structures or reached nearby lymph nodes. It has spread to distant lymph nodes or to other organs such as the liver, bones, or brain.

Small cell lung cancer survival rates by stage

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

The 5-year survival rate refers to the percentage of patients who live *at least* 5 years after their cancer is diagnosed. Of course, many of these people live longer than 5 years.

To get 5-year survival rates, doctors 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 small cell lung cancer (SCLC).

Five-year *relative* survival rates (such as the numbers below) compare the survival rates for patients with the cancer to those of people without the cancer. This is a better way to see the impact of cancer on survival.

The rates below are based on the stage of the cancer *at the time of diagnosis*. When looking at survival rates, it's important to understand that the stage of a cancer does not change over time, even if the cancer progresses. A cancer that spreads or comes back is still referred to by the stage it was given when it was first found, but more information is added to explain the current extent of the cancer. (And of course, the treatment plan is adjusted based on the change in cancer status.)

The numbers below are relative survival rates calculated from the National Cancer Institute's Surveillance, Epidemiology, and End Results (SEER) database, based on people who were diagnosed with small cell lung cancer between 1988 and 2001.

These survival rates are based on the TNM staging system in use at the time, which has since been modified slightly for the latest version. Because of this, the survival numbers may be slightly different for the latest staging system.

Stage	5-year Relative Survival Rate
I	31%
II	19%
III	8%
IV	2%

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. Knowing the type and the stage of a person's cancer helps estimate their outlook. But many other factors can also affect a person's outlook, such as a person's overall health, the treatment received, and how well the cancer responds to treatment. Even when taking these other factors into account, survival rates are at best rough estimates. Your doctor can tell you how the numbers above may apply to you.

How is small cell lung cancer treated?

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

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

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

Making treatment decisions for small cell lung cancer

After the cancer is found and staged, your cancer care team will discuss your treatment options with you. Depending on the stage of the disease and other factors, the main treatment options for people with small cell lung cancer (SCLC) include:

- Chemotherapy
- Radiation therapy

- Surgery

If you have SCLC, you will probably get chemotherapy if you are healthy enough. If you have limited stage disease, radiation therapy and – rarely – surgery may be options as well.

You may have different types of doctors on your treatment team, depending on the stage of your cancer and your treatment options. These doctors may include:

- A medical oncologist: a doctor who treats cancer with medicines such as chemotherapy.
- A pulmonologist: a doctor who specializes in medical treatment of diseases of the lungs.
- A radiation oncologist: a doctor who treats cancer with radiation therapy.
- A thoracic surgeon: a doctor who treats diseases in the lungs and chest with surgery.

Many other specialists may be involved in your care as well, including physician assistants, nurse practitioners, nurses, respiratory therapists, social workers, and other health professionals.

It is important to discuss all of your treatment options as well as their possible side effects with your doctors to help make the decision that best fits your needs. (See the section "What should you ask your doctor about small cell lung cancer?") One of the most important factors in choosing a treatment plan is the stage of the cancer, so be sure your doctor has ordered all the tests needed to determine the cancer's stage.

Other factors to consider include your overall health, the likely side effects of the treatment, and the probability of curing the disease, extending life, or relieving symptoms. Age alone should not be a barrier to treatment. Older people can benefit from treatment as much as younger people as long as their general health is good.

If time permits, it is often a good idea to get a second opinion. This can provide you with more information and help you feel more confident about the treatment plan that you choose. Your doctor should be willing to help you find another cancer doctor who can give you a second opinion. If you have already had tests done, the results can be sent to the second doctor so that you will not have to have them done again.

The next few sections describe the various types of treatments used for small cell lung cancer. This is followed by a description of the most common approaches used for these cancers based on the stage of the cancer.

Chemotherapy for small cell lung cancer

Chemotherapy (chemo) is treatment with anti-cancer drugs injected into a vein or taken by mouth. These drugs enter the bloodstream and go throughout the body, making this treatment useful for cancer anywhere in the body. Chemo is usually the main treatment for small cell lung cancer (SCLC).

Doctors give chemo in cycles, with a period of treatment (usually 1 to 3 days) followed by a rest period to allow your body time to recover. Each cycle generally lasts about 3 to 4 weeks, and initial treatment is typically 4 to 6 cycles. Chemo is often not recommended for patients in poor health, but advanced age by itself is not a reason to not get chemotherapy.

Chemo for SCLC is generally given as a combination of 2 drugs at first. The combinations most often used to treat SCLC are:

- Cisplatin and etoposide
- Carboplatin and etoposide
- Cisplatin and irinotecan
- Carboplatin and irinotecan

If the cancer progresses (get worse) during treatment or returns after treatment is finished, other chemo drugs may be tried. The choice of drugs depends to some extent on how soon the cancer begins to grow again. (The longer it takes for the cancer to return, the more likely it is to respond to further treatment.)

- If cancer returns more than 6 months after treatment, it might respond again to the same chemo drugs that were given the first time, so these can be tried again.
- If the cancer comes back sooner, or if it keeps growing during treatment, further treatment with the same drugs isn't likely to be helpful. If further chemo is given, most doctors prefer treatment with a single, different drug at this point to help limit side effects. Topotecan, which can either be given into a vein (IV) or taken as pills, is the drug most often used, although others might also be tried.

SCLC that progresses or comes back can be hard to treat with the drugs now available, so taking part in a clinical trial of newer treatments might be a good option for some people.

Possible side effects of chemotherapy

Chemo drugs attack 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 (where new blood cells are made), 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. These side effects can include:

- Hair loss
- Mouth sores
- Loss of appetite
- Nausea and vomiting
- Diarrhea or constipation
- Increased chance of infections (from having too few white blood cells)
- Easy bruising or bleeding (from having to few blood platelets)
- Fatigue (from having too few red blood cells)

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.

Some drugs can have specific side effects. For example, drugs such as cisplatin and carboplatin can damage nerve endings. This, called *peripheral neuropathy*, can sometimes lead to symptoms (mainly in the hands and feet) such as pain, burning or tingling sensations, sensitivity to cold or heat, or weakness. In most people this goes away or gets better after treatment is stopped, but it may be long lasting in some people. For more information, see our document *Peripheral Neuropathy Caused by Chemotherapy*.

Cisplatin can also cause kidney damage. To help prevent this, doctors give lots of IV fluids before and after each dose of the drug is given.

You should report any side effects you notice while getting chemo to your medical team so that they can be treated promptly. In some cases, the doses of the chemo drugs may need to be reduced or treatment may need to be delayed or stopped to prevent the effects from getting worse.

For more information, please see the “Chemotherapy” section of our website, or our document *A Guide to Chemotherapy*. You can also learn more about each drug mentioned above by visiting our *Guide to Cancer Drugs* or calling us at 1-800-227-2345.

Radiation therapy for small cell lung cancer

Radiation therapy uses high-energy rays (such as x-rays) or particles to kill cancer cells. The type of radiation therapy most often used to treat small cell lung cancer (SCLC) is called external beam radiation therapy (EBRT). It delivers radiation from outside the body and focuses it on the cancer.

Radiation therapy may be used in several situations:

- It can be given at the same time as chemotherapy (chemo) in limited stage disease to treat the tumor and lymph nodes in the chest. Giving chemo and radiation together is called *concurrent chemoradiation*. The radiation may be started with the first or second cycle of chemo.
- Radiation can also be given after all the chemo is finished. This is sometimes done in patients with extensive stage disease or people with limited stage disease who are not able to tolerate getting chemotherapy and radiation at the same time (as an alternative to chemoradiation).
- SCLC often spreads to the brain. Radiation can be given to the brain to help lower the chances of problems from cancer that has spread there but isn't visible on imaging tests. This is called *prophylactic cranial irradiation*. This is most often used to treat people with limited stage SCLC, but it can help some people with extensive stage SCLC, too.
- Radiation can be used to shrink tumors to palliate (relieve) symptoms of lung cancer such as bleeding, trouble swallowing, cough, shortness of breath, bone pain, and problems caused by spread to other organs such as the brain.

Before treatments start, your radiation team will take careful measurements to find the correct angles for aiming the radiation beams and the proper dose of radiation. Treatment is much like getting an x-ray, but the radiation is more intense. The procedure itself is painless. Each treatment lasts only a few minutes, although the setup time – getting you into place for treatment – usually takes longer.

Most often, radiation treatments as part of the initial treatment for SCLC are given once or twice daily, 5 days a week, for 3 to 7 weeks. Radiation to relieve symptoms and prophylactic cranial radiation are given for shorter periods of time, typically less than 3 weeks.

Standard (conventional) EBRT is used much less often than in the past. Newer techniques help doctors treat lung cancers more accurately while lowering the radiation exposure to nearby healthy tissues. These techniques may offer better success rates and fewer side effects. Most doctors now recommend using these newer techniques when they are available.

- **Three-dimensional conformal radiation therapy (3D-CRT):** 3D-CRT uses special computer programs to precisely map the location of the tumor(s). Radiation beams are shaped and aimed at the tumor(s) from several directions, which makes it less likely to damage normal tissues.
- **Intensity modulated radiation therapy (IMRT):** IMRT is an advanced form of 3D therapy. It uses a computer-driven machine that moves around the patient as it delivers radiation. Along with shaping the beams and aiming them at the tumor from several angles, the intensity (strength) of the beams can be adjusted to limit the dose reaching the most sensitive normal tissues. This technique is used most often if tumors are near important structures such as the spinal cord. Many major hospitals and cancer centers now use IMRT.

Possible side effects of radiation therapy

Common side effects of radiation therapy can include:

- Sunburn-like skin problems
- Hair loss (in the area where the radiation enters the body)
- Fatigue (tiredness)
- Nausea and vomiting
- Loss of appetite and weight loss

Radiation therapy can affect the blood-forming cells in the bone marrow. This can lead to low blood cell counts. The red blood cells and white blood cells are most often affected by radiation, but sometime the platelets are affected, too. This can lead to:

- Increased chance of infections (from too few white blood cells)
- Easy bruising or bleeding (from too few blood platelets)
- Feeling weak or short of breath after walking only a short distance (from too few red blood cells)

Most of these side effects go away after treatment, but some can last a long time, or may even be permanent. When chemotherapy is given with radiation, the side effects are often worse.

Radiation therapy to the chest may damage your lungs, which might cause a cough, problems breathing, and shortness of breath. These usually improve after treatment is over, although sometimes they may not go away completely.

Your esophagus, which is in the middle of your chest, may be exposed to radiation, which could cause a sore throat and trouble swallowing during or shortly after the

treatment course. This might make it hard to eat anything other than soft foods or liquids for a while.

Radiation therapy to large areas of the brain can sometimes cause memory loss, headaches, trouble thinking, or reduced sexual desire. Usually these symptoms are minor compared with those caused by a brain tumor, but they can reduce your quality of life. Side effects of radiation therapy to the brain usually become most serious 1 or 2 years after treatment. For more information, please see the "Radiation Therapy" section of our website or our document *Understanding Radiation Therapy: A Guide for Patients and Families*.

Surgery for small cell lung cancer

Surgery is rarely used as the main treatment in small cell lung cancer (SCLC). Occasionally (in fewer than 1 out of 20 patients), the cancer is found as only a single lung tumor, with no spread to lymph nodes or other organs. Surgery may be an option for these early stage cancers, usually followed by additional treatment (chemotherapy, often with radiation therapy).

If your doctor thinks the lung cancer can be treated with surgery, pulmonary function tests will be done first to see if you would still have enough healthy lung tissue remaining after surgery. Other tests will check the function of your heart and other organs to be sure you're healthy enough for surgery.

Because more advanced stage lung cancers are not helped by surgery, your doctor will also want to make sure the cancer hasn't already spread to the lymph nodes between the lungs. This can be done before surgery with mediastinoscopy or with some of the other techniques described in the section "How is small cell lung cancer diagnosed?"

Types of lung surgery

When surgery is being considered for SCLC, the first step often involves making sure that the cancer hasn't spread to the lymph nodes in the middle of the chest. The surgeon will do biopsies under bronchoscopy or mediastinoscopy (these were discussed in the section "How is small cell lung cancer diagnosed?"). If the lymph nodes contain cancer, then surgery is not a good treatment for SCLC.

Different operations can be used to treat lung cancers. These operations require general anesthesia (where you are in a deep sleep) and are usually done through a surgical incision between the ribs in the side of the chest (called a *thoracotomy*).

- Pneumonectomy: an entire lung is removed.
- Lobectomy: an entire section (lobe) of a lung is removed.
- Segmentectomy or wedge resection: part of a lobe is removed.

- Sleeve resection: a section of a large airway is removed and the lung is reattached.

In general, lobectomy is the preferred operation for SCLC if it can be done, because it offers a better chance of removing all of the cancer than segmentectomy or wedge resection.

With any of these operations, nearby lymph nodes are also removed to look for possible spread of the cancer.

When you wake up from surgery, you will have a tube (or tubes) coming out of your chest and attached to a special canister to allow excess fluid and air to drain out. The tube(s) will be removed once the fluid drainage and air leak subside. Most people will spend about a week in the hospital after the surgery.

Video-assisted thoracic surgery: Some doctors now treat some early stage lung cancers near the outside of the lung with a procedure called *video-assisted thoracic surgery* (VATS), which requires smaller incisions than a thoracotomy.

During this operation, a thin, hollow tube with a tiny video camera on the end is placed through a small cut in the side of the chest to help the surgeon see inside the chest on a TV monitor. One or two other small cuts are created in the skin, and long instruments are passed though these holes to cut away the tumor. One of the incisions may need to be enlarged to remove the lung specimen. Because smaller incisions are needed, there is less pain after the surgery and a shorter hospital stay, usually around 4 to 5 days.

Most experts recommend that only early stage tumors near the outside of the lung be removed this way. The cure rate after this surgery seems to be the same as with surgery done with a larger incision. But it is important that the surgeon be experienced with this procedure because it requires a great deal of technical skill.

Possible risks and side effects of lung surgery

Possible complications during and soon after surgery depend on the extent of the surgery and a person’s health beforehand. Serious complications can include excess bleeding, wound infections, and pneumonia. While it is rare, in some cases people may not survive the surgery, so it is important to talk with your doctors to be sure you are a good candidate for surgery.

Surgery for lung cancer is a major operation, and recovering from the operation typically takes weeks to months. When the surgery is done through a thoracotomy, the surgeon must spread ribs to get to the lung, so the area near the incision will hurt for some time after surgery. Your activity will be limited for at least a month.

If your lungs are in good condition (other than the presence of the cancer) you can usually return to normal activities after some time if a lobe or even an entire lung has been removed. If you also have non-cancerous lung diseases such as emphysema or

chronic bronchitis (which are common among heavy smokers), you may become short of breath with activity after surgery.

Palliative procedures for small cell lung cancer

In some cases, surgery (or other localized techniques) may be used to help treat the symptoms of the cancer (as opposed to trying to remove all of the cancer).

Treating airway blockage

Tumors can sometimes grow into the lung airways, blocking them and causing problems such as pneumonia or shortness of breath. Sometimes this is treated with radiation therapy (described in the "Radiation therapy for small cell lung cancer" section), but other techniques can also be used.

Photodynamic therapy (PDT)

Photodynamic therapy is sometimes used to treat very early stage lung cancers that are still confined to the outer layers of the lung airways when other treatments aren't appropriate. It can also be used to help open up airways blocked by tumors to help people breathe better.

For this technique, a light-activated drug called porfimer sodium (Photofrin®) is injected into a vein. This drug is more likely to collect in cancer cells than in normal cells. After a couple of days (to give the drug time to build up in the cancer cells), a bronchoscope is passed down the throat and into the lung. This may be done with either local anesthesia (where the throat is numbed) and sedation or with general anesthesia (where you are in a deep sleep). A special laser light on the end of the bronchoscope is aimed at the tumor, which activates the drug and causes the cells to die. The dead cells are then removed a few days later during a bronchoscopy. This process can be repeated if needed.

PDT may cause swelling in the airway for a few days, which may lead to some shortness of breath, as well as coughing up blood or thick mucus. Some of this drug also collects in normal cells in the body, such as skin and eye cells. This can make you very sensitive to sunlight or strong indoor lights. Too much exposure can cause serious skin reactions (like a severe sunburn), so doctors recommend staying out of any strong light for 4 to 6 weeks after the injection.

For more information, please see our document *Photodynamic Therapy*.

Laser therapy

Lasers can sometimes be used to treat very small lung cancers in the linings of airways. They can also be used to help open up airways blocked by larger tumors to help people breathe better.

You are usually asleep (under general anesthesia) for this type of treatment. The laser is on the end of a bronchoscope, which is passed down the throat and next to the tumor. The doctor then aims the laser beam at the tumor to burn it away. This treatment can usually be repeated, if needed.

Stent placement

Lung tumors that have grown into an airway can sometimes cause trouble breathing or other problems. To help keep the airway open (often after other treatments such as PDT or laser therapy), a hard silicone or metal tube called a *stent* may be placed in the airway using a bronchoscope.

Treating fluid buildup in the area around the lung

Sometimes fluid can build up in the chest outside of the lungs (called a pleural effusion). It can press on the lungs and cause trouble breathing.

Thoracentesis

This is done to drain the fluid. A doctor will numb an area in the chest, and then place a needle into the space between the lungs and the ribs and drain the fluid. This is often done using ultrasound to guide the needle into the area of fluid buildup.

Pleurodesis

A *pleurodesis* might be done to remove the fluid and keep it from coming back.

One way to do this is to make a small cut in the skin of chest wall, and place a hollow tube (called a chest tube) into the chest to remove the fluid. Then a substance is instilled into the chest cavity through the tube that causes the linings of the lung (visceral pleura) and chest wall (parietal pleura) to become irritated. This causes the linings to stick together, sealing the space and limiting further fluid buildup. The tube is often left in for a couple of days to drain any new fluid that might collect. A number of agents can be placed through the tube to irritate the linings, such as talc, the antibiotic doxycycline, or a chemotherapy drug like bleomycin.

Another way to do this is to blow talc into the space around the lungs (the pleural space) during an operation. This is done through a small incision using thoracoscopy

Catheter placement

This is another way to control the buildup of fluid. One end of the catheter (a thin, flexible tube) is placed in the chest through a small cut in the skin, and the other end is left outside the body. This is done in a doctor’s office or hospital. Once in place, the catheter can be attached to a special bottle or other device to allow the fluid to drain out on a regular basis.

Treating fluid buildup around the heart

Lung cancer can sometimes spread to the area around the heart. This can lead to fluid buildup (a pericardial effusion) that presses on the heart so that it doesn't work well.

Pericardiocentesis

In this procedure, the fluid is drained with a needle placed into the space around the heart. This is usually done using an echocardiogram (like an ultrasound of the heart), to guide the needle.

Pericardial window

This is done to keep the fluid from building up again. In an operation, a piece of the tissue around the heart (the pericardium) is removed to allow the fluid to drain into the chest or belly.

Clinical trials for small-cell lung cancer

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

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

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

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. Sometimes they might be the only way to get access to some newer treatments. They are also 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 *Clinical Trials: What You Need to Know*.

Complementary and alternative therapies for small-cell lung cancer

When you have cancer you are likely to hear about ways to treat your cancer or relieve symptoms that your doctor hasn't mentioned. Everyone from friends and family to Internet groups and websites may 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 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 few or no side effects sounds great. Sometimes medical treatments like chemotherapy can be hard to take, or they may no longer be working. But the truth is that most of these alternative methods have not been tested and proven to work in treating cancer.

- As you consider your options, here are 3 important steps you can take:
- Look for "red flags" that suggest fraud. Does the method promise to cure all or most cancers? Are you told not to have regular medical treatments? Is the treatment a "secret" that requires you to visit certain providers or travel to another country?
- Talk to your doctor or nurse about any method you are thinking about using.

- Contact us at 1-800-227-2345 to learn more about complementary and alternative methods in general and to find out about the specific methods you are looking at. You can also find them in the “Complementary and Alternative Medicine” section of our website.

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 choices by stage for small cell lung cancer

As mentioned in “How is small cell lung cancer staged?”, for practical reasons small cell lung cancer (SCLC) is usually staged as either limited or extensive. In most cases, SCLC has already spread by the time it is found (even if that spread is not seen on x-rays and other imaging tests), so it usually cannot be treated by surgery. If you are healthy enough, you will probably get chemotherapy (chemo), regardless of the stage of your disease.

If you smoke, one of the most important things you can do to be ready for treatment is to try to quit. Studies have shown that patients who stop smoking after a diagnosis of lung cancer tend to have better outcomes than those who don’t.

Stage I SCLC

If you only have a single small tumor in your lung with no evidence of cancer in lymph nodes or elsewhere, your doctors may recommend surgery to remove the tumor and the nearby lymph nodes. This is only an option if you are in fairly good health and able to tolerate removing all or part of a lung. You will be checked for signs of cancer spread to the lymph nodes in the chest with mediastinoscopy or other tests before this is considered. Very few patients with SCLC are treated this way.

Surgery is generally followed by chemotherapy. Radiation therapy to the chest is usually advised as well if cancer is found in the lymph nodes that were removed. The radiation is often given at the same time as the chemo. Although this increases the side effects of treatment, it appears to be more effective than giving one treatment after the other. You might not be given radiation therapy if you already have severe lung disease (in addition to your cancer) or other serious health problems.

In about half of people with SCLC, the cancer will eventually spread to the brain if no preventive measures are taken. For this reason, you may be given radiation therapy to the head (*prophylactic cranial irradiation*, or PCI) to try to prevent this. The radiation is

usually given in lower doses than that for treatment of known metastases. Still, some patients given PCI may have side effects, such as those described in the “Radiation therapy” section.

Limited stage SCLC

For most people with limited stage SCLC, surgery is not an option because the tumor is too large, or it has spread to nearby lymph nodes or other places in the lung. If you are in good health, the standard treatment is chemo plus radiation to the chest given at the same time) called *concurrent chemoradiation*. The chemo drugs used are usually etoposide (VP-16) plus either cisplatin or carboplatin.

Concurrent chemoradiation can help people who have limited stage SCLC live longer and give them a better chance at cure than giving one treatment (or one treatment at a time). The downside is that this combination has more severe side effects than either chemo or radiation alone, and it can be hard to take.

People who aren’t likely to tolerate chemo and radiation together (because they are frail or in poor health) are usually treated with chemo by itself. This may be followed by radiation to the chest.

Whatever treatment is chosen, it is important that you quit smoking if you haven’t already. Smoking during treatment is linked to worse survival.

If no preventive measures are taken, about half of people with SCLC will have cancer spread (metastasis) to their brain. If your cancer has responded well to initial treatment, you may be given radiation therapy to the head (*prophylactic cranial irradiation*, or PCI) to try to prevent spread to the brain. The radiation is usually given in lower doses than than what is used if the cancer had already spread to brain, but some patients given PCI may still have side effects, such as those described in the “Radiation therapy” section.

Most people treated with chemo (with or without radiation) for their limited stage SCLC will have their tumors shrink significantly. In many, the cancer will shrink to the point where it can no longer be seen on imaging tests. Unfortunately, for most people, the cancer will return at some point.

Clinical trials of new chemo drugs and combinations, as well as other new treatments, are being done to improve on current treatment results. Because these cancers are hard to cure, a clinical trial may be a good option for some people. If you think you might be interested in taking part in a clinical trial, talk to your doctor.

Extensive stage SCLC

If you have extensive SCLC and are in fairly good health, chemotherapy (chemo) can often treat your symptoms and also help you live longer. The most commonly used combination is etoposide plus either cisplatin or carboplatin. Most people will have their

cancer shrink significantly with chemo, and in some the cancer may no longer be seen on imaging tests. Unfortunately, the cancer will still return at some point in almost all people with extensive stage SCLC.

If the cancer responds well to chemo, radiation treatments to the chest may be given. This can help people with extensive stage SCLC live longer. Radiation to the brain (known as *prophylactic cranial irradiation*, or PCI) may also be considered to help prevent future problems.

Because these cancers are hard to treat, clinical trials of new chemotherapy drugs and combinations, as well as other new treatments, may be a good option for some people. If you think you might be interested in taking part in a clinical trial, talk to your doctor.

Radiation therapy is sometimes used to help shrink tumors and control symptoms in a specific part of the body, such as if cancer growth within the lungs is causing shortness of breath or bleeding. Other types of treatment, such as laser surgery, can also sometimes be helpful in these situations. Radiation therapy can also be used to relieve symptoms if the cancer has spread to the bones or brain.

If your general health is poor, you might not be able to withstand the side effects of standard chemo or benefit from it. In that case, your doctor may treat you with lower doses of chemo or palliative/supportive care alone. This would include treatment of any pain, breathing problems, or other symptoms you might have.

Cancer that progresses or recurs after treatment

If the cancer continues to grow during treatment or comes back, any further treatment will depend on the location and extent of the cancer, what treatments have been used, and on the person's health and desire for further treatment. It is always important to understand the goal of any further treatment before it starts – if it is to try to cure the cancer, to slow its growth, or to help relieve symptoms – as well as the likelihood of benefits and risks.

If a cancer continues to grow during chemotherapy, another type of chemotherapy may be tried, although it may be less likely to be effective. For cancers that come back after initial treatment is finished, the choice of chemotherapy drugs may depend on how long the cancer was in remission (see the "Chemotherapy for small cell lung cancer" section).

If treatment is no longer working

At some point, it may become clear that standard treatments are no longer controlling the cancer. If you want to continue anti-cancer treatment, you might think about taking part in a clinical trial of newer lung cancer treatments. Although these are not always the best option for every person, they may benefit you as well as future patients.

Even if your cancer can't be cured, you should be as free of symptoms as possible. If curative treatment is not an option, treatment aimed at specific areas of cancer can often relieve symptoms and may even slow the spread of the disease. Symptoms caused by cancer in the lung airways – such as shortness of breath or coughing up blood – can often be treated effectively with radiation therapy or other palliative treatments if needed. Radiation therapy can be used to help control cancer spread in the brain or relieve pain if cancer has spread to the bones.

Many people with lung cancer are concerned about pain. If the cancer grows near certain nerves it can sometimes cause pain, but this can almost always be treated effectively with pain medicines. Sometimes radiation therapy or other treatments will help as well. It is important that you talk to your doctor and take advantage of these treatments.

Deciding on the right time to stop treatment aimed at curing the cancer and focus on care that relieves symptoms is never easy. Good communication with doctors, nurses, family, friends, and clergy can often help people facing this situation.

For more information, please see "What happens if treatment for small cell lung cancer is no longer working?"

More treatment information for small cell lung cancer

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

The NCI provides treatment guidelines via its telephone information center (1-800-4-CANCER) and its website (www.cancer.gov). Detailed guidelines intended for use by cancer care professionals are also available on www.cancer.gov.

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. These are available on the NCCN website (www.nccn.org).

What should you ask your doctor about small cell lung cancer?

It is important for you to have honest, open discussions with your cancer care team. You should feel free to ask any question, no matter how small it might seem. Nurses, social workers, and other members of the treatment team may also be able to answer many of your questions. Here are some questions you might want to ask:

- What kind of lung cancer do I have?
- Where exactly is the cancer? Has it spread beyond where it started?

- What is the stage of my cancer, and what does that mean in my case?
- Are there other tests that need to be done before we can decide on treatment?
- Are there other doctors I need to see?
- How much experience do you have treating this type of cancer?
- What treatment choices do I have?
- What do you recommend and why?
- What is the goal of the treatment?
- What is my expected survival rate, based on my cancer as you see it?
- What risks or side effects are there to the treatments you suggest? How long are they likely to last?
- How quickly do we need to decide on treatment?
- What should I do to be ready for treatment?
- How long will treatment last? What will it involve? Where will it be done?
- How will treatment affect my daily activities?
- What would we do if the treatment doesn't work or if the cancer comes back?
- What type of follow-up would I need after treatment?

Along with these sample questions, be sure to write down some of your own. For instance, you might want to ask about second opinions or about clinical trials for which you may qualify. You can find more information about communicating with your health care team in our document *Talking With Your Doctor*.

What happens after treatment for small cell lung cancer?

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

It may take a while before your fears lessen. But it may help to know that many cancer survivors have learned to live with this uncertainty and are living full lives. Our

document *Living With Uncertainty: The Fear of Cancer Recurrence* gives more detailed information on this.

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

Follow-up care

During and after treatment, your doctors will want to watch you closely. It is very important to keep all follow-up appointments. During these visits, your doctors will ask about symptoms, do physical exams, and may order blood tests or imaging tests such as CT scans or x-rays.

In people with no signs of cancer remaining, many doctors recommend follow-up visits (which may include CT scans and blood tests) about every 3 months for the first couple of years after treatment, about every 6 months for the next several years, then at least yearly after 5 years. Some doctors may advise different follow-up schedules.

Follow-up is needed to look for signs of cancer recurrence or spread, as well as possible side effects of certain treatments. This is a good time for you to ask your health care team any questions you need answered and to discuss any concerns you might have.

Each type of treatment for lung cancer can have side effects. Some may last for a few weeks to several months, but others can last the rest of your life. Be sure to report any new symptoms right away, and tell your cancer care team about any symptoms or side effects that bother you so they can help you manage them.

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

If cancer does recur, treatment will depend on where the cancer is and what treatments you've had before. Radiation therapy, chemotherapy, or other types of treatment might be helpful. For more on how recurrent cancer is treated, see the section "Treatment choices by stage for small cell lung cancer." For more general information on dealing with a recurrence, you may also want to look at our document *When Your Cancer Comes Back: Cancer Recurrence*.

Seeing a new doctor

At some point after your cancer diagnosis and treatment, you may find yourself seeing a new doctor who does not know about your medical history. It is important that you be able to give your new doctor the details of your diagnosis and treatment. Gathering these

details soon after treatment may be easier than trying to get them at some point in the future. Make sure you have the following information handy:

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

Lifestyle changes after small cell lung cancer

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

Make healthier choices

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

You can start by working on those things that worry you most. Get help with those that are harder for you. For instance, if you smoke, one of the most important things you can do to improve your chances for treatment success is to quit. Studies have shown that patients who stop smoking after a diagnosis of lung cancer have better outcomes than those who don't. Quitting can help improve lung function and have other health benefits as well. If you are thinking about quitting smoking and need help, call the American Cancer Society at 1-800-227-2345.

Eating better

Eating right can be hard for anyone, but it can get even tougher during and after cancer treatment. Treatment may change your sense of taste. Nausea can be a problem. You may

not feel like eating and lose weight when you don't want to. Or you may have gained weight that you can't seem to lose. All of these things can be very frustrating.

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

One of the best things you can do after cancer treatment is put healthy eating habits into place. You may be surprised at the long-term benefits of some simple changes, like increasing the variety of healthy foods you eat. Getting to and staying at a healthy weight, eating a healthy diet, and limiting your alcohol intake may lower your risk for some other types of cancer, as well as having many other health benefits. Get more information in our document *Nutrition and Physical Activity During and After Cancer Treatment: Answers to Common Questions*.

Rest, fatigue, and exercise

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

If you were sick and not very active during treatment, it is normal for your fitness, endurance, and muscle strength to decline. Any plan for physical activity should fit your own situation. An older person who has never exercised will not be able to take on the same amount of exercise as a 20-year-old who plays tennis twice a week. If you haven't exercised in a few years, you will have to start slowly – maybe just by taking short walks.

Talk with your health care team before starting anything. Get their opinion about your exercise plans. Then, try to find an exercise buddy so you're not doing it alone. Having family or friends involved when starting a new exercise program can give you that extra boost of support to keep you going when the push just isn't there. You can read more in our document *Nutrition and Physical Activity During and After Cancer Treatment: Answers to Common Questions*.

If you are very tired, you will need to balance activity with rest. It is OK to rest when you need to. Sometimes it's really hard for people to allow themselves to rest when they are used to working all day or taking care of a household, but this is not the time to push yourself too hard. Listen to your body and rest when you need to. (For more information on fatigue and other side effects, please see the "Physical Side Effects" section of our website or "Additional resources for small cell lung cancer" to get a list of available information.)

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

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

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

Can I lower my risk of the cancer progressing or coming back?

Most people want to know if there are specific lifestyle changes they can make to reduce their risk of cancer progressing or coming back. Unfortunately, for most cancers there is isn't much solid evidence to guide people. This doesn't mean that nothing will help – it's just that for the most part this is an area that hasn't been well studied. Most studies have looked at lifestyle changes as ways of preventing cancer in the first place, not slowing it down or preventing it from coming back.

However, there are some things people can do that might help them live longer or reduce the risk of lung cancer returning.

Quitting smoking: If you smoke, quitting is important. Quitting has been shown to help people with lung cancer live longer, even when the cancer has spread. It also lowers the chance of getting another lung cancer, which is especially important for people with early stage lung cancer.

Of course, quitting smoking may have other health benefits as well, including lowering the risk of some other cancers. If you need help quitting, talk to your doctor or call the American Cancer Society at 1-800-227-2345.

Diet and nutrition: The possible link between diet and lung cancer growing or coming back is much less clear. Some studies have suggested that diets high in fruits and vegetables might help prevent lung cancer from developing in the first place, but this has not been studied in people who already have lung cancer.

On the other hand, studies have found that beta carotene supplements may actually increase the risk of lung cancer in smokers. Because of the lack of data in this area, it's

important to talk with your health care team before making any major changes to your diet (including taking any supplements) to try to improve your outlook.

How might having small cell lung cancer affect your emotional health?

During and after treatment, you may find yourself overcome with many different emotions. This happens to a lot of people.

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

Almost everyone who is going through or has been through cancer can benefit from getting some type of support. You need people you can turn to for strength and comfort. Support can come in many forms: family, friends, cancer support groups, church or spiritual groups, online support communities, or one-on-one counselors. What's best for you depends on your situation and personality. Some people feel safe in peer-support groups or education groups. Others would rather talk in an informal setting, such as church. Others may feel more at ease talking one-on-one with a trusted friend or counselor. Whatever your source of strength or comfort, make sure you have a place to go with your concerns.

The cancer journey can feel very lonely. It is not necessary or good for you to try to deal with everything on your own. And your friends and family may feel shut out if you do not include them. Let them in, and let in anyone else who you feel may help. If you aren't sure who can help, call your American Cancer Society at 1-800-227-2345 and we can put you in touch with a group or resource that may work for you. You can also read our document *Distress in People with Cancer* or see the "Emotional Side Effects" section of our website for more information.

What happens if treatment for small cell lung cancer is no longer working?

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

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

If you want to continue to get treatment for as long as you can, you need to think about the odds of treatment having any benefit and how this compares to the possible risks and side effects. In many cases, your doctor can estimate how likely it is the cancer will respond to treatment you are considering. For instance, the doctor may say that more treatment might have about a 1 in 100 chance of working. Some people are still tempted to try this. But it is important to have realistic expectations if you do choose this plan.

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

Palliative care helps relieve symptoms, but is not expected to cure the disease. It can be given along with cancer treatment, or can even be cancer treatment. The difference is its purpose – the main goal of palliative care is to improve the quality of your life, or help you feel as good as you can for as long as you can. Sometimes this means using medicines to help with symptoms like pain or nausea. Sometimes, though, the treatments used to control your symptoms are the same as those used to treat cancer. For instance, radiation might be used to help relieve bone pain caused by cancer that has spread to the bones. Or chemo might be used to help shrink a tumor and keep it from blocking the bowels. But this is not the same as treatment to try to cure the cancer. You can learn more about the changes that occur when curative treatment stops working, and about planning ahead for yourself and your family, in our documents *Nearing the End of Life* and *Advance Directives*.

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

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

What’s new in small cell lung cancer research and treatment?

Research into the prevention, early detection, and treatment of small cell lung cancer is being done in many medical centers throughout the world.

Prevention

Tobacco

Prevention offers the greatest opportunity to fight lung cancer. Although decades have passed since the link between smoking and lung cancers became clear, smoking is still responsible for at least 80% of lung cancer deaths, and this percentage is likely even higher for small cell lung cancers. Research is continuing on:

- Ways to help people quit smoking and stay quit through counseling, nicotine replacement, and other medicines
- Ways to convince young people to never start smoking
- Inherited differences in genes that may make some people much more likely to get lung cancer if they smoke or are exposed to someone else’s smoke

Environmental causes

Researchers also continue to look into some of the other causes of lung cancer, such as exposure to radon and diesel exhaust. Finding new ways to limit these exposures could potentially save many more lives.

Diet, nutrition, and medicines

Researchers are looking for ways to use vitamins or medicines to prevent lung cancer in people at high risk, but so far none have been shown conclusively to reduce risk.

Some studies have suggested that a diet high in fruits and vegetables may offer some protection, but more research is needed to confirm this. While any protective effect of fruits and vegetables on lung cancer risk is likely to be much less than the increased risk from smoking, following the American Cancer Society dietary recommendations (such as maintaining a healthy weight and eating a diet high in fruits, vegetables, and whole grains) may still be helpful.

Early detection

As mentioned in the section “Can small cell lung cancer be found early?”, a large clinical trial called the National Lung Screening Trial (NLST) found that spiral CT scans in people at high risk of lung cancer (due to smoking history) lower the risk of death from lung cancer, when compared to chest x-rays. This finding has led to the development of screening guidelines for lung cancer.

Another approach now being studied uses newer, more sensitive tests to look for cancer cells in sputum samples. Researchers have found several changes often seen in the DNA of lung cancer cells. Current studies are looking at new tests that can spot these DNA changes to see if they can find lung cancers at an earlier stage.

Diagnosis

Fluorescence bronchoscopy

Also known as *autofluorescence bronchoscopy*, this technique may help doctors find some lung cancers earlier, when they may be easier to treat. For this test, the doctor inserts a bronchoscope through the mouth or nose and into the lungs. The end of the bronchoscope has a special fluorescent light on it, instead of a normal (white) light.

The fluorescent light causes abnormal areas in the airways to show up in a different color than healthy parts of the airway. Some of these areas might not be visible under white light, so the color difference may help doctors find these areas sooner. Some cancer centers now use this technique to look for early lung cancers, especially if there are no obvious tumors seen with normal bronchoscopy.

Virtual bronchoscopy

This imaging test uses CT scans to create detailed 3-dimensional pictures of the airways in the lungs. The images can be seen as if the doctor were actually using a bronchoscope.

Virtual bronchoscopy has some possible advantages over standard bronchoscopy. First, it is non-invasive and doesn’t require anesthesia. It also helps doctors look at some airways that might not be seen with standard bronchoscopy, such as those being blocked by a tumor. But it has some drawbacks as well. For example, it doesn’t show color changes in the airways that might indicate a problem. It also doesn’t let a doctor take samples of suspicious areas like bronchoscopy does. Still, it may be a useful tool in some situations, such as in people who might be too sick to get a standard bronchoscopy.

This test will probably become more available as the technology improves.

Treatment

Real-time tumor imaging

Researchers are looking to use new imaging techniques, such as four-dimensional computed tomography (4DCT), to help improve treatment. In this technique, the CT machine scans the chest continuously for about 30 seconds. It shows where the tumor is in relation to other structures as a person breathes, as opposed to just giving a ‘snapshot’ of a point in time, like a standard CT does.

4DCT can be used to determine exactly where the tumor is during each part of the breathing cycle, which can help doctors deliver radiation to a tumor more precisely. This technique might also be used to help show if a tumor is attached to or invading important structures in the chest, which could help doctors determine if a patient might be eligible for surgery.

Chemotherapy

Many clinical trials are looking at newer combinations of chemotherapy drugs to determine which are the safest and most effective. This is especially important in patients who are older and have other health problems. Doctors are also searching for better ways to combine chemotherapy with radiation therapy and other treatments.

Targeted therapies

Researchers are learning more about the inner workings of lung cancer cells that control their growth and spread. This is being used to develop new targeted therapies. These drugs work differently from standard chemotherapy drugs. They might work in some cases when standard chemo drugs don’t, and they often have different (and less severe) side effects. Many of these treatments are being tested in clinical trials to see if they can help people with lung cancer live longer or relieve their symptoms.

Anti-angiogenesis drugs: For cancers to grow, new blood vessels must develop to nourish the cancer cells within tumors. This process is called angiogenesis. New drugs that inhibit angiogenesis are being studied as lung cancer treatments.

Some are used for other cancer types. For example, a drug called bevacizumab (Avastin) has been shown to help patients with some types of non-small cell lung cancer. In studies of small cell lung cancer, it has helped stop some of the cancers from growing for a time, but so far it hasn’t been shown to help patients live longer.

Other drugs that affect blood vessel growth, such as sunitinib (Sutent) and nintedanib (BIBF 1120), are also being tested for use against SCLC.

Immune treatments

Researchers are hoping to develop drugs that can help the body's immune system fight the cancer.

Ipilimumab (Yervoy): This drug targets CTLA-4, a protein in the body that normally suppresses the immune response. Blocking this protein might help the immune system attack cancer cells. The drug is already used to treat melanoma, and it is now being studied in other cancers, including SCLC.

Vaccines: Several types of vaccines for boosting the body's immune response against lung cancer cells are being tested in clinical trials. Unlike vaccines against infections like measles or mumps, these vaccines are designed to help treat, not prevent, lung cancer. These types of treatments seem to have very limited side effects, so they might be useful in people who can't tolerate other treatments. At this time, vaccines are only available in clinical trials.

Immune check point inhibitors: These are a promising class of new agents that are being studied for the treatment of lung cancer. In SCLC, the development of these compounds has just started recently.

Additional resources for small cell lung cancer

More information from your American Cancer Society

Here is more information you might find helpful. You also can order free copies of our documents from our toll-free number, 1-800-227-2345, or read them on our website, www.cancer.org.

Living with cancer

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

Caring for the Patient With Cancer at Home: A Guide for Patients and Families (also in Spanish)

Distress in People With Cancer

Guide to Controlling Cancer Pain (also in Spanish)

Living with Uncertainty: The Fear of Cancer Recurrence

When Your Cancer Comes Back: Cancer Recurrence

Advanced Cancer

Understanding cancer treatments

A Guide to Cancer Surgery (also in Spanish)

A Guide to Chemotherapy (also in Spanish)

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

Lasers in Cancer Treatment

Cancer treatment side effects

Nausea and Vomiting

Anemia in People With Cancer

Fatigue in People With Cancer

Peripheral Neuropathy Caused by Chemotherapy

Family and caregiver concerns

Talking With Friends and Relatives About Your Cancer (also in Spanish)

What It Takes to Be a Caregiver

Helping Children When a Family Member Has Cancer: Dealing With Diagnosis (also in Spanish)

Work, insurance, and finances

Health Insurance and Financial Assistance for the Cancer Patient

Returning to Work After Cancer Treatment

Working During Cancer Treatment

Carcinogens and lung cancer

Asbestos

Diesel Exhaust

Radon

Questions About Smoking, Tobacco, and Health (also in Spanish)

Guide to Quitting Smoking (also in Spanish)

When treatment stops working

Nearing the End of Life

Advance Directives

Hospice Care

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

National organizations and Websites*

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

American Lung Association
Toll-free number 1-800-586-4872 (1-800-LUNGUSA)
Website: www.lungusa.org

> Offers information on lung cancer and coping with breathing problems, side effects, and physical activity

Lungcancer.org
Toll-free number: 1-800-813-4673 (1-800-813-HOPE)
Website: www.lungcancer.org

> Provides information, support, and other assistance to people with lung cancer. Also offers phone counseling and telephone support groups for people with lung cancer, with online support for caregivers

Lung Cancer Alliance
Toll-free number: 1-800-298-2436
Website: www.lungcanceralliance.org

> Offers lung cancer treatment information, including a lung cancer information line, as well as a phone buddy program, referrals to support groups, and more

National Cancer Institute
Toll-free number: 1-800-422-6237 (1-800-4-CANCER)
Website: www.cancer.gov

> Provides information on all types of cancer, living with cancer, support information for families of people with cancer, research, and more

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

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

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