Lung Cancer (Small Cell)

What is cancer?

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

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

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

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

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

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

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

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

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

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

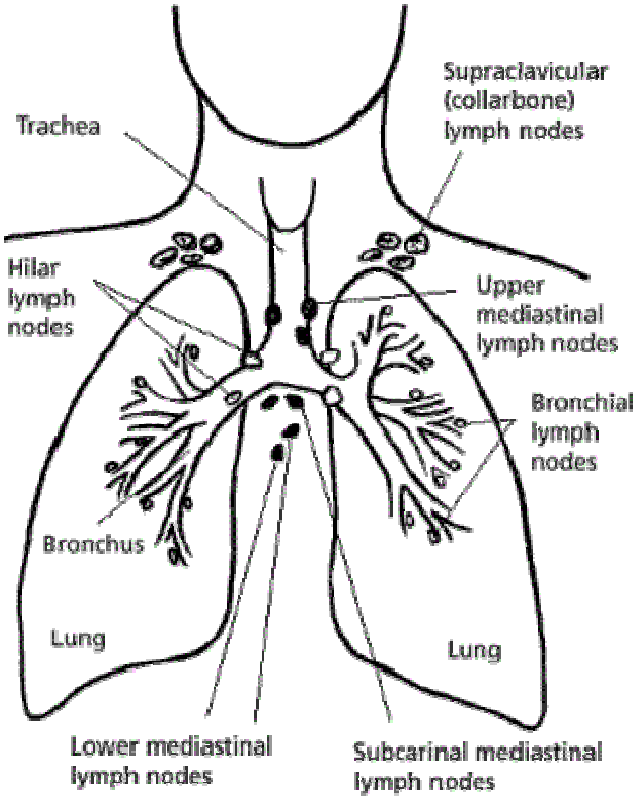
What is small cell lung cancer?

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 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 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 happen in the genes of the cells themselves and may cause them to grow faster. The 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, these pre-cancerous changes in the cells may progress to true cancer. As a cancer develops, the cancer cells may make chemicals that cause new blood vessels to form nearby. These new blood vessels nourish the cancer cells, which can continue to grow and form a tumor large enough to 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 important to understand because it 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). When 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 to some extent on whether or not the cancer has spread to certain groups of lymph nodes. 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 characteristics of both types it is called a *mixed small cell/large cell carcinoma*. This is uncommon.)

These 2 main types of lung cancer are discussed separately because their treatments are very different. **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 small cells that make up these cancers. 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, and it tends to spread widely through the body fairly early in the course of the disease (usually before it starts to cause symptoms). The cancer cells can multiply quickly and spread to lymph nodes and other organs, such as the bones, brain, adrenal glands, and liver. Sometimes the areas of cancer spread are seen as large tumors on x-rays and other imaging tests, but early on these areas may not be visible (but still there). SCLC spreads early, so removing the tumor in the lung rarely cures the cancer. This is why surgery is rarely used to treat SCLC (and never the only treatment given). On the other hand, chemotherapy, which can reach cancer cells throughout the body, is the main treatment for small cell lung cancers.

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.

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*.

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

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 depends on where it started (the primary cancer site). For information on these cancers, refer to our specific 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 men (after prostate cancer) and women (after breast cancer). It accounts for about 14% of all new cancers.

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

- About 226,160 new cases of lung cancer will be diagnosed (116,470 in men and 109,690 among women).
- There will be an estimated 160,340 deaths from lung cancer (87,750 in men and 72,590 among women), accounting for about 28% of all cancer deaths.

Lung cancer is by far the leading cause of cancer death among both men and women. 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 older than 65; fewer than 3% of all cases are found in people under the age of 45. The average age at the time of diagnosis is about 71.

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 40% more likely to develop lung cancer than white men. The rate is about the same in black women and 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 for many years. In women, the rate has just begun to drop after a long period of increasing.

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, "How is small cell lung cancer staged?"

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. For example, unprotected exposure to strong sunlight is a risk factor for skin cancer.

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 part of the 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.

About 80% of all lung cancer deaths are thought to result from smoking – 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.

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. For help with quitting, see our document *Guide to Quitting Smoking* or call the American Cancer Society at 1-800-227-2345.

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. A non-smoker who lives with a smoker has about a 20% to 30% greater risk of developing lung cancer. Workers who have been exposed to tobacco smoke in the workplace are also more likely to get lung cancer. Secondhand smoke is thought to cause more than 3,000 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.

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. In some parts of the United States, houses 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.

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. 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, and if you work around these products, you should be careful to limit your exposure whenever possible.

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. Typical patients are those 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

High levels of arsenic in drinking water may increase the risk of lung cancer. This is even more pronounced in smokers.

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 only smoke a little. At this time these DNA changes cannot be routinely tested for. Research in this area is ongoing.

Certain dietary supplements

Studies looking at the possible role of antioxidant 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.

Air pollution

In cities, air pollution (especially from 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.

Factors with uncertain or unproven effects on lung cancer risk

Marijuana

There are some reasons to think that marijuana smoking might increase lung cancer risk. Many of the cancer-causing substances in tobacco are also found in marijuana. Marijuana contains more tar than cigarettes. (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. And because marijuana is an illegal substance, it is not 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 of cigarettes a day (10 cigarettes), 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 it is not easy to gather information about the use of illegal drugs. Also, many marijuana smokers also smoke cigarettes. This makes it hard to know how much of the risk is from tobacco and how much might be from marijuana. In the very limited studies done so far, marijuana use has not been strongly linked to lung cancer, but more research in this area is needed.

Talc and talcum powder

Talc is a mineral that in its natural form may contain asbestos. In the past, some studies suggested that talc miners and millers have a higher risk of lung cancer and other respiratory diseases because of their exposure to industrial grade talc. Recent 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?

Tobacco smoking is by far the leading cause of small cell lung cancer. Still, although most small cell lung cancers are related to smoking, some are not. These may be caused by other things, such as the other known risk factors that were described in the section, "What are the risk factors for small cell lung cancer?" A small portion of lung cancers occur in people with no known risk factors for the disease.

Gene changes that may lead to lung cancer

Scientists have begun to understand how the known risk factors for lung cancer may produce certain changes in the DNA of cells in the lungs, causing them to grow abnormally and form cancers. 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. However, 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 and divide. Genes that promote cell division 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. However, inherited mutations 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 prepares to divide 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 reliable enough for routine use. 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 being exposed to factors in the environment, such as the cancer-causing chemicals in tobacco smoke. But some gene changes may just be random events that sometimes happen inside a cell, without having an external cause.

Acquired changes in certain genes, such as the p53 and Rb 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 likely to grow and spread more rapidly 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 cases of lung cancer 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 small cell lung cancer (and other types of lung cancer) is not to smoke and to avoid breathing in other people's 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 apparent 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, non-curable stage. 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 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. Still, small cell lung cancer tends to spread very early, and so most lung cancers that are found early are the non-small cell type.

Does screening for lung cancer save lives?

Screening is the use of tests or exams to detect a disease in people without symptoms of that disease. For example, the Pap test is used to screen for cervical cancer in women with no signs or symptoms of the disease. Because lung cancer usually spreads beyond the lungs before causing any symptoms, an effective screening test for lung cancer could save many lives.

For many years, doctors have been trying to determine if the early detection of lung cancer can save lives. Until recently, no lung cancer screening test had been shown to lower the risk of dying from this disease. Studies of 2 possible screening tests, chest x-ray and sputum cytology, did find that these tests detected lung cancers at an early stage, but neither test helped patients live longer. For this reason, major medical organizations have not recommended routine screening with these tests for the general public or even for people at increased risk, such as smokers. Recently, though, a different lung cancer screening test has been shown to help lower the risk of dying from this disease.

Low-dose spiral CT

A type of CT scan known as low-dose spiral CT (or helical CT) has shown some promise in detecting early lung cancers in heavy smokers and former smokers. Spiral CT of the chest provides more detailed pictures than a chest x-ray and is better at finding small abnormalities in the lungs. It is often used if lung cancer is suspected based on symptoms. The type of spiral CT used for lung cancer screening is called *low-dose* because it uses lower amounts of radiation than a standard chest CT. This type also does not require the use of intravenous (IV) contrast dye.

The National Lung Screening Trial (NLST) is a large clinical trial that compared spiral CT scans 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 with at least a 30 pack-year history of smoking (equal to smoking a pack a day for 30 years, or 2 packs a day for 15 years). Former smokers must have quit within the past 15 years. People were not eligible for the study if they had a prior history of lung cancer or lung cancer symptoms, or if they needed to be on oxygen at home to help them breathe.

People in the study got either 3 spiral CT scans or 3 chest x-rays, each a year apart. They were then observed for several years to see how many people in each group died of lung cancer.

The study found that people who got spiral CT had a 20% 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.

Still, there are some questions that still need to be answered. For example, it's not clear if screening with spiral CT scans would have the same effect on different groups of people, such as those who smoked less (or not at all) or people younger than age 55. It's also not clear what the best screening schedule might be (how often the scans should be done, how long they should be continued, etc.). Also, the lung cancers that were found early were the non-small cell type, so it is not yet clear how to find small cell lung cancer early.

Screening with spiral CT 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 turn out not to be cancer but that still need to be assessed to be sure. (About 1 out of 4 people in the NLST had such a finding.) This may lead to additional tests such as CT scans, or even more invasive tests such as needle biopsies or even surgery to remove a portion of lung in some people. A small number of people who do not have cancer or have very early stage cancer have died from these tests.

Spiral CT 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 is also a concern. When done in tens of thousands of people, this radiation will cause a few people to develop breast, lung, and thyroid cancers later on.

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

Current screening recommendations

Although the American Cancer Society has not yet developed lung cancer screening guidelines, it has plans to do so in the future. In the meantime, some people who are at higher risk (and their doctors) may consider whether screening is appropriate for them.

While a full cancer screening guideline is being developed, the American Cancer Society has created interim guidance for people and their doctors regarding the use of low-dose CT scans for the early detection of lung cancer:

- People between the ages of 55 and 74 who meet the entry criteria of the NLST (see above) and are concerned about their risk of lung cancer may consider screening for lung cancer. With their doctor, people interested in screening should weigh the currently known benefits of screening with the currently known limits and risks in order to make a shared decision as to whether they should be screened for lung cancer.

- Doctors may choose to discuss lung cancer screening with their patients who meet NLST entry criteria.

- For people who do not meet the NLST entry criteria (because of younger age, smoking history, etc.), it is not clear if the possible benefits of screening outweigh the harms, so screening in these people is not recommended at this time. This is especially the case among people with no smoking history, in whom the possible harms are much more likely than benefits at this time. Whether people whose age or smoking history would have made them ineligible for the NLST should be screened will be addressed during the guidelines development process as more data becomes available.

- People who choose to be screened should follow the NLST protocol for annual screening. This should be done in an organized screening program at an institution with expertise in spiral CT screening, with access to a multidisciplinary team skilled in finding and treating abnormal lung lesions. Referring doctors should help their patients find institutions with this expertise.

- There is always benefit to quitting smoking. Active smokers entering a lung screening program should be urged to enter a smoking cessation program. Screening should not be viewed as an alternative to quitting smoking.

- For people considering screening (and their doctors), some statistics from the NLST may be helpful. Of the nearly 26,000 people screened by low-dose CT in the NLST, 1,060 were diagnosed with lung cancer. Screening is estimated to have prevented 88 lung cancer deaths while causing 16 deaths. Six of the 16 deaths were in patients who ultimately were found not to have cancer.

For more detailed information on the interim guidance, please see the document *American Cancer Society Interim Guidance on Lung Cancer Screening*.

Even with the promising results from the NLST, people who are current smokers should realize that the best way to avoid dying from lung cancer is to stop smoking. For help quitting smoking, see our document *Guide to Quitting Smoking* or call the American Cancer Society at 1-800-227-2345.

How is small cell lung cancer diagnosed?

Most lung cancers are not found until they start to cause symptoms. Symptoms can suggest that a person may have lung cancer, but the actual diagnosis is made by looking at lung cells under a microscope.

Common signs and symptoms of 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)
- Jaundice (yellowing of the skin and eyes)
- Lumps near the surface of the body, due to cancer spreading to the skin or to lymph nodes (collection of immune system cells) in the neck or above the collarbone

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 may make hormone-like or other substances that enter the bloodstream and cause problems with distant tissues and organs, even though the cancer has not spread to those tissues or organs. These problems are called *paraneoplastic 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 makes 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 have 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. Small cell lung cancer 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.

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 may have lung cancer, more involved tests will likely be done. These might 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 recurrence 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 (but 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

The CT or CAT scan is a test that 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 and organs 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.

CT scans take longer than regular x-rays, and they expose you to a small amount of radiation. The test itself is painless, other than, perhaps, the insertion of the IV line. You need to lie still on a table while it is being done. During the test, the table slides in and out of the scanner, a ring-shaped machine that completely surrounds the table. You might feel a bit confined by the ring you have to lie in while the pictures are being taken.

A CT scan can provide precise information about the size, shape, and position of any tumors and can help find enlarged lymph nodes that might contain cancer that has spread from the lung. CT scans are more sensitive (better) than routine chest x-rays in finding early lung cancers.

Most patients with SCLC will have 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 patients will have a CT of the brain to look for cancer spread, but an MRI may be done instead.

CT guided needle biopsy: In cases where 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 remain 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 doctors 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

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 are a little more uncomfortable than CT scans. First, they take longer − often up to an hour. Second, you have to lie inside a narrow tube, which is confining and can upset people with claustrophobia (a fear of enclosed spaces). Special, “open” MRI machines can sometimes help with this if needed, although the images may not be as sharp in some cases. MRI machines make buzzing and clicking noises that you may find disturbing. Some centers provide earplugs to help block this noise out.

Most patients with SCLC will have an MRI scan to look for possible cancer spread to the brain, 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.

Positron emission tomography (PET) scan

For a PET scan, a form of radioactive sugar (known as fluorodeoxyglucose or FDG) is injected into the blood. The amount of radioactivity used is very low. Cancer cells in the body are growing rapidly, so they absorb large amounts 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.

This 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 your chest x-ray may 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.

Some machines are able to perform both a PET and CT scan at the same time (PET/CT scan). This lets the doctor compare areas of higher radioactivity on the PET with the more detailed appearance of that area on the CT. This is the type of PET most often used in SCLC patients.

Bone scan

A bone scan can help show if a cancer has metastasized (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 appear as "hot spots" on your skeleton – that is, they attract the radioactivity. These areas may suggest the presence of 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 simple 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.

Other tests to diagnose lung cancer and its spread

Bronchoscopy

This test 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 (bronchoscope) is passed through your 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.

Bronchoscopy can help the doctor find some tumors or blockages in the larger airways of the lungs. At the same time, 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.

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 emits 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 much more useful in staging non-small cell lung cancer.

Endoscopic esophageal ultrasound

This technique is similar to 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. Ultrasound images taken from inside the esophagus can help find large lymph nodes 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 much more useful in staging 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 are not often used for cases of small cell lung cancer. They are much more useful in staging 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. Special 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 allows the surgeon to reach lymph nodes that cannot be reached by mediastinoscopy.

Thoracentesis

Thoracentesis is done to relieve symptoms caused by a buildup of fluid around the lungs (pleural effusion) and to see if this fluid buildup is 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 build-up can keep the lungs from filling with air, so thoracentesis can help the patient breathe better.

Thoracoscopy

This procedure can be done to find out if cancer has spread to the space between the lungs and the chest wall, or to the linings of these spaces. 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 sufficient samples for the diagnosis. It may be done to see if the cancer has spread to the pleura (the membrane around the lung).

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" 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 are 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. These tests may be done in patients thought to have limited stage small cell lung cancer but who have blood test results suggesting the cancer may have reached the bone marrow.

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 patients 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.

Sampling tissues and cells

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

The cells can be obtained from lung secretions (phlegm), or the cells can be removed from a suspicious area (known as a 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.

A pathologist, a doctor who uses lab tests to diagnose diseases such as cancer, will look at the cells under a microscope. The results will be 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.

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 cancer cells are present. The best way to do this is to get early morning samples from you 3 days in a row.

Fine needle aspiration (FNA) biopsy

A needle biopsy can often be used to get a small sample of cells from a suspicious area. For this test, the skin on the chest wall where the needle is to be inserted may be numbed with local anesthesia. The doctor then guides a thin, hollow needle into the area while looking at your 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 provide a continuous 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 small sample of the mass is then sucked into a syringe and sent to a lab, where it is looked at under the microscope to see if cancer cells are present. (In some cases, if the diagnosis isn't clear based on the FNA biopsy, a larger needle may be used to remove a slightly bigger piece of lung tissue. This is known as a *core needle biopsy*.)

A needle biopsy may be useful for getting samples from tumors in the outer portions of the lungs, where other tests such as bronchoscopy (described below) may not be as helpful.

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 may 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 take samples of lymph nodes around the trachea (windpipe) and bronchi (the larger airways leading into the lungs). This can be done during a bronchoscopy (described in the previous section). A thin, hollow needle is inserted through the end of the bronchoscope and through the wall of the trachea or bronchus to sample the nearby lymph nodes. This procedure is called a *transtracheal FNA* or *transbronchial FNA* and is most accurate when guided by endobronchial ultrasound as described in the previous section.

Lab tests of biopsy and other samples

Samples that have been collected during biopsies or other tests are sent to a pathology lab. There, a doctor views the samples under a microscope to find out if they contain cancer and if so, what type of cancer it is. Special tests may be needed 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.

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 contains 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 are often done to get a sense of a person's overall health and to help tell if cancer may have spread to other areas.

Prior to surgery, blood tests can help tell if a person is healthy enough to have an operation.

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 may 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 liver and bones, it may cause abnormal levels of certain chemicals in the blood, such as a higher than normal level of lactate dehydrogenase (LDH).

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. Since surgery is rarely used to treat small cell lung cancer, these tests are not often done for patients known to have small cell lung cancer..

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

How is small cell lung cancer staged?

Staging is the process of finding out how far a cancer has spread. Your treatment and prognosis (outlook) depend, to a large extent, on the cancer's stage. There are actually 2 types of staging.

- 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 small cell lung cancer 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 small cell lung cancer (SCLC).

Limited and extensive stage

For treatment purposes, most doctors prefer the 2-stage system that divides small cell lung cancers into limited stage and extensive stage. The stage of a cancer does not change over time, even if the cancer progresses. A cancer that comes back or spreads is still referred to by the stage it was given when it was first found and diagnosed, only information about the current extent of the cancer is added. A person keeps the same diagnosis stage, but more information is added to the diagnosis to explain the current disease status.

Limited stage usually means that the cancer is only in one side of the chest (called a hemithorax). This can include one lung and the lymph nodes on the same side of the chest. Lymph nodes above the collarbone (*clavicle*) are included 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.”

Extensive stage is used to describe cancers that have spread 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 small cell lung cancer that has spread to the fluid around the lung to be extensive stage as well. About 2 out of 3 people with small cell lung cancer have extensive disease when their cancer is first found.

Small cell lung cancer is often staged in this way because it helps separate patients who may benefit from more aggressive treatments such as chemotherapy combined with radiation therapy to try to cure the cancer (limited stage) from those for whom these treatments aren't likely to cure the cancer (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. This system is used more often for non-small cell lung cancer. It is used less often for SCLC, mainly because treatment options don't vary much between these detailed stages. 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 that help fight infections. Cancers often spread to the lymph nodes 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 letter X means "cannot be assessed because the information is not available."

The TNM staging system is complex and can be difficult 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 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 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 between 3 cm and 7 cm across (larger than 3 cm 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 prognosis. Patients with lower stage numbers tend to have a better prognosis.

Occult 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 3 and 5 cm across (larger than 3 cm 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 between 3 and 5 cm across (larger than 3 cm but not larger than 5 cm).
- The tumor involves 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 between 5 and 7 cm across (larger than 5 cm 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 between 5 and 7 cm across (larger than 5 cm 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 the 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 know them, stop reading here and skip to the next section.

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

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.

Survival rates are often based on previous outcomes of large numbers of people who had the disease, but they cannot predict what will happen to any particular person. Knowing the type and the stage of a person's cancer is important in estimating their outlook. But many other factors may also affect a person's outlook, such as how well the cancer responds to treatment and a person's overall health. Even when taking these other factors into account, survival rates are at best rough estimates. Your doctor can tell you how the numbers below may apply to you.

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%

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.

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.

Making treatment decisions for small cell lung cancer

Depending on the stage of the disease and other factors, the main treatment options for people with small cell lung cancer (SCLC) include:

- Surgery
- Radiation therapy
- Chemotherapy

If you have small cell lung cancer, 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.

After the cancer is found and staged, your cancer care team will discuss your treatment options with you. It is important to take time and think about all of your possible choices.

In choosing a treatment plan, one of the most important factors to consider is the stage of the cancer. For this reason, it is very important that your doctor order 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.

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 nurse practitioners, nurses, respiratory therapists, social workers, and other health professionals.

Small-cell lung cancer surgery

Surgery is rarely used as the main form of treatment in small cell lung cancer (SCLC). Occasionally (fewer than 1 out of 20 cases), the cancer is found as only one localized tumor nodule, with no spread to lymph nodes or other organs. Surgery may be an option 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 determine whether you will 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

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

- Pneumonectomy: an entire lung is removed.

- Lobectomy: a section (lobe) of the 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 small cell lung cancers treated with surgery.

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

You will generally need to 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 is less invasive than a thoracotomy.

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

Most experts recommend that only tumors smaller than 3 to 4 centimeters (about 1 ½ inches) near the outside of the lung be removed this way. The cure rate after this surgery seems to be the same as with older techniques. But it is important that the surgeon be experienced with this procedure since 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 excessive bleeding, wound infections, and pneumonia. While it is rare, in some cases people may not survive the surgery, which is why it is very important that surgeons select patients carefully.

Surgery for lung cancer is a major operation, and recovering from the operation typically takes weeks to months. The surgeon must spread ribs to get to the lung when doing a thoracotomy, so 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 activities after surgery.

Surgery and other techniques to relieve symptoms of SCLC

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). For example, tumors can sometimes grow into airways, blocking them and causing problems such as pneumonia or shortness of breath. Treatments such as laser surgery can be used to relieve the blockage in the airway. This is done using a special type of laser on the end of a bronchoscope to destroy the tumor cells. A bronchoscope may also be used to place a metal or silicone tube (called a *stent*) in the airway after treatment to help keep it open. Other techniques like radiation therapy (described in the "Radiation therapy" section) may also be used.

Sometimes fluid can build up in the chest cavity outside of the lungs. It can press on the lungs and cause trouble breathing. To remove the fluid and keep it from coming back, doctors sometimes perform a procedure called *pleurodesis*. A small cut is made in the skin of chest wall, and a hollow tube is placed into the chest to remove the fluid. Either talc or a drug such as doxycycline or a chemotherapy drug is then instilled into the chest cavity. This causes the linings of the lung (visceral pleura) and chest wall (parietal pleural) to stick together, sealing the space and limiting further fluid buildup. The tube is generally left in for a couple of days to drain any new fluid that might accumulate.

Radiation therapy for small-cell lung cancer

Radiation therapy uses high-energy rays (such as x-rays) or particles to kill cancer cells. External beam radiation therapy (EBRT) delivers radiation from outside the body that is focused on the cancer. This is the type of radiation therapy most often used to treat small cell lung cancer.

In small cell lung cancer (SCLC), radiation therapy may be used in several situations:

- It is most often given at the same time as chemotherapy in limited stage disease to treat the tumor and lymph nodes in the chest. After chemotherapy, radiation therapy is sometimes used to kill any small deposits of cancer that may remain.
- It can be used to shrink tumors to palliate (relieve) symptoms of lung cancer such as bone pain, bleeding, trouble swallowing, cough, shortness of breath, and problems caused by brain metastases.
- In limited SCLC, it is often given to the brain after other treatments, to help reduce the chances that the cancer will spread there. (The brain is a common site of metastasis.) This is called *prophylactic cranial irradiation*.

Before your treatments start, the radiation team will take careful measurements to find the correct angles for aiming the radiation beams and the proper dose of radiation. Radiation therapy 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.

Standard (conventional) EBRT isn't used as much as it used to be. Newer techniques help doctors treat lung cancers more accurately while lowering the radiation exposure to nearby healthy tissues. These techniques may offer better chances of increasing the success rate and reducing 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 minimize 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.

Possible side effects of radiation therapy

Common side effects of radiation therapy include;

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

Radiation therapy can affect the blood-forming cells in the bone marrow. This can lead to low blood 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 low white blood cell counts)
- Easy bruising or bleeding (from low blood platelet counts)
- Fatigue (from low red blood cell counts)

When chemotherapy is given with radiation, many of the side effects are worse.

Chest radiation therapy may cause some damage to your lungs, which might cause a cough, problems breathing, and shortness of breath. These usually improve after treatment is over, although in some cases the symptoms 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 treatment. This may 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.

Most side effects improve and go away after treatment, but some can last a long time, or may even be permanent.

For more general information about radiation therapy, please see our document, *Understanding Radiation Therapy: A Guide for Patients and Families*.

Small-cell lung cancer chemotherapy

Chemotherapy 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 that has spread (metastasized) to organs beyond the lung. Chemotherapy is usually the main treatment for small cell lung cancer (SCLC).

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

Chemotherapy for SCLC generally uses a combination of 2 drugs. The drug combinations most often used for initial chemotherapy for SCLC are:

- Cisplatin and etoposide
- Carboplatin and etoposide
- Cisplatin and irinotecan
- Carboplatin and irinotecan
- Cyclophosphamide, doxorubicin (Adriamycin®), and vincristine

If the cancer progresses (get worse) during treatment or returns after treatment is finished, different chemotherapy 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 the cancer progresses during treatment or relapses (returns) within 2 to 3 months of finishing treatment, drugs such as topotecan, ifosfamide, paclitaxel, docetaxel, irinotecan, or gemcitabine may be tried.
- If the relapse occurs from 2 to 3 months to 6 months after treatment, topotecan is often the drug of choice. Other drugs that may be tried include irinotecan, the CAV regimen (cyclophosphamide, doxorubicin, and vincristine), gemcitabine, paclitaxel, docetaxel, oral etoposide, or vinorelbine.
- For relapses 6 or more months after treatment, the original chemotherapy regimen may still be effective and can often be tried again.

Possible side effects of chemotherapy

Chemotherapy drugs work by attacking cells that are dividing quickly, which is why they work against cancer cells. But other cells in the body, such as those in the bone marrow (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 low white blood cell counts)
- Easy bruising or bleeding (from low blood platelet counts)
- Fatigue (from low red blood cell counts)

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

Some side effects can be more long lasting. For example, drugs such as cisplatin, vinorelbine, docetaxel, or paclitaxel can damage nerves. This 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. This is called *peripheral neuropathy*. In most cases this improves after treatment is stopped, but it may be long lasting in some people. For more information, see our document, *Peripheral Neuropathy Caused by Chemotherapy*.

Also, cisplatin can cause kidney damage (called *nephropathy*). To help prevent this, doctors give lots of fluid IV before and after each dose of the drug is given.

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

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

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 Web site at www.cancer.org/clinicaltrials. You can also get a list of current clinical trials by calling the National Cancer Institute's Cancer Information Service toll-free at 1-800-4-CANCER (1-800-422-6237) or by visiting the NCI clinical trials Web site at www.cancer.gov.

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

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

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

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 Web sites 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.

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 alone. 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 chemo (see the "Chemotherapy" section for more details on commonly used drugs). Radiation 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 may not be given radiation therapy if you already have severe lung disease (in addition to your cancer) or other serious health problems.

Limited stage SCLC

For most cases of limited stage SCLC, surgery is not an option because the tumor is too large, or 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 (given at the same time). People given these treatments together live longer and have a better chance of cure, but this treatment combination is hard to take.

If you have lung problems or other major health problems, chemotherapy may be given alone.

If no preventive measures are taken, about half of people with SCLC will have cancer spread (metastasis) to their brain. For this reason, 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 that for treatment of known metastases. Still, some patients given PCI may have side effects, such as those described in the "Radiation therapy" section.

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

Clinical trials of new chemotherapy 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 can often treat your symptoms and also help you live longer. (See the "Chemotherapy" section for more details on commonly used drugs.) About 3 out of 4 people will have their cancer shrink significantly with chemotherapy. 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 brain may also be considered to prevent future problems (*prophylactic cranial irradiation).*

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 may not be able to withstand the side effects of chemotherapy or benefit from it. In this case, your doctor may select a treatment plan based on your individual medical situation. If you are too ill to have chemotherapy, the best plan may be to have supportive care. This would include treatment of any pain, breathing problems, or other symptoms you might have.

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 extent of the cancer, what treatments have been used, and a 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" section).

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 sites 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, laser therapy, or other local 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.

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 Web site (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 Web site (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. They want to answer all of your questions, no matter how minor you might think they are. Some questions to consider:

- What kind of lung cancer do I have?

- Has my cancer spread beyond the primary site?
- What is the stage of my cancer and what does that mean in my case?
- 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?
- What would we do if the treatment doesn't work or if the cancer recurs?
- What type of follow-up would I need after treatment?

In addition to 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.

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, most doctors recommend follow-up visits (which may include CT scans and blood tests) about every 2 to 3 months for the first year after treatment, every 3 to 6 months for the next several years, then at least yearly after 5 years.

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

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. It is important for you to report any new or recurring symptoms right away. Don't hesitate to tell your cancer care team about any symptoms or side effects that bother you so they can help you manage them.

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 the location of the cancer and what treatments you've had before. For more information 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*. You can get this document by calling 1-800-227-2345.

Seeing a new doctor

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

- A copy of your pathology report(s) from any biopsies or surgeries
- If you had surgery, a copy of your operative report(s)
- If you were 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 put on a DVD)

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

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 the alcohol, or give up tobacco. Even things like keeping your stress level under control may help. Now is a good time to think about making changes that can have positive effects for the rest of your life. You will feel better and you will also be healthier.

You can start by working on those things that worry you most. Get help with those that are harder for you. For instance, if you 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 a host of 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.

Rest, fatigue, and exercise

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

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

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

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

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

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

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

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. It has been shown to help improve outcomes and reduce the risk of recurrence, especially in 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: Possible links between diet and lung cancer progression or recurrence are much less clear. As noted earlier, 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 dietary changes (including taking any supplements) to try to improve your prognosis.

How does 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 may 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.

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 shrink the cancer enough to help you live longer and feel better. But when a person has tried many different treatments and the cancer has not gotten any better, the cancer tends to become resistant to all treatment. If this happens, it's important to weigh the possible limited benefits of a new treatment against the possible downsides, 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 medical treatments and nothing's working anymore. Your doctor may offer you new options, but at some point you may need to consider that treatment is not likely to improve your health or change your outcome or survival.

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

No matter what you decide to do, 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 purpose of palliative care is to improve the quality of your life, or help you feel as good as you can for as long as you can. Sometimes this means using drugs to help with symptoms like pain or nausea. Sometimes, though, the treatments used to control your symptoms are the same as those used to treat cancer. For instance, radiation might be used to help relieve bone pain caused by cancer that has spread to the bones. Or chemo might be used to help shrink a tumor and keep it from blocking the bowels. But this is not the same as treatment to try to cure the cancer.

At some point, you may benefit from hospice care. This is special care that treats the person rather than the disease; it focuses on quality rather than length of life. Most of the time, it is given at home. Your cancer may be causing problems that need to be managed, and hospice focuses on your comfort. You should know that while getting hospice care

often means the end of treatments such as chemo and radiation, it doesn't mean you can't have treatment for the problems caused by your cancer or other health conditions. In hospice the focus of your care is on living life as fully as possible and feeling as well as you can at this difficult time. You can learn more about hospice in our document called *Hospice Care*.

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

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

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

Prevention

Tobacco

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

- Ways to help people quit smoking 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

Diet, nutrition, and medicines

Although researchers are looking for ways to use vitamins or medicines to prevent lung cancer in people at high risk, 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. For now, most researchers think that simply 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 be the best strategy.

Early detection

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

As mentioned in the section "Can non-small cell lung cancer be found early?", a large clinical trial called the National Lung Screening Trial (NLST) found that spiral CT scanning in people at high risk of lung cancer (due to smoking history) lowered the risk of death from lung cancer, when compared to chest x-rays. What this finding means for screening should become more apparent in the near future.

Another approach uses newer, more sensitive tests to look for cancer cells in sputum samples. Researchers have recently found several changes that often affect the DNA of lung cancer cells. Current studies are looking at new diagnostic tests that specifically recognize these DNA changes to see if this approach is useful in finding 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 allow a doctor to 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

Chemotherapy

Many clinical trials are being done to compare the effectiveness of newer combinations of chemotherapy drugs. These studies are also looking to reduce side effects, especially 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.

Some new chemotherapy drugs, such as amrubicin and picoplatin, have shown promising results in early studies and are now being tested in larger clinical trials.

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 often have different (and less severe) side effects. Many of these treatments are already being tested in clinical trials to see if they can help people with advanced 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 have already been successfully 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 a study of small cell lung cancer, it helped stop some of the cancers from growing for a time, but didn’t seem to help the patients live longer. Other drugs already approved for use against other types of cancer, such as sunitinib (Sutent) and sorafenib (Nexavar), are also being tested for use against 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. One possible advantage of these types of treatments is that they 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.

Additional resources for small-cell lung cancer

More information from your American Cancer Society

The following related information may also be helpful to you. These materials may be ordered from our toll-free number, 1-800-227-2345.

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

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

Guide to Quitting Smoking (also available in Spanish)

Lasers in Cancer Treatment

Living with Uncertainty: The Fear of Cancer Recurrence

Pain Control: A Guide for Those With Cancer and Their Loved Ones (also available in Spanish)

Peripheral Neuropathy Caused by Chemotherapy

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

Surgery (also available in Spanish)

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

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

When Your Cancer Comes Back: Cancer Recurrence

The following books are available from the American Cancer Society. Call us at 1-800-227-2345 (1-800-227-2345) to ask about costs or to place your order.

American Cancer Society Complete Guide to Complementary & Alternative Cancer Therapies

American Cancer Society Complete Guide to Nutrition for Cancer Survivors

American Cancer Society's Guide to Pain Control

Cancer in the Family: Helping Children Cope with a Parent's Illness

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

What Helped Get Me Through: Cancer Patients Share Wisdom and Hope

What to Eat During Cancer Treatment

When the Focus Is on Care: Palliative Care and Cancer

National organizations and Web sites*

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)
Web site: www.lungusa.org

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

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

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

**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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