

# Lung Cancer



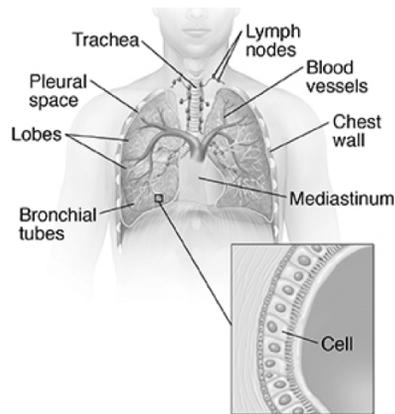
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## Lung cancer is a disease in which malignant (cancer) cells form in the tissues of the lung.

The lungs are a pair of cone-shaped breathing organs in the chest. The lungs bring oxygen into the body as you breathe in. They release carbon dioxide, a waste product of the body's cells, as you breathe out. Each lung has sections called lobes. The left lung has two lobes.

The right lung is slightly larger and has three lobes. Two tubes called bronchi lead from the trachea (windpipe) to the right and left lungs. The bronchi are sometimes also involved in lung cancer. Tiny air sacs called alveoli and small tubes called bronchioles make up the inside of the lungs.

A thin membrane called the pleura covers the outside of each lung and lines the inside wall of the chest cavity. This creates a sac called the pleural cavity. The pleural cavity normally contains a small amount of fluid that helps the lungs move smoothly in the chest when you breathe.



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## Signs of lung cancer include a cough that does not go away, shortness of breath, and chest pain.

Sometimes lung cancer does not cause any signs or symptoms. It may be found during a CT scan or a chest x-ray done for another condition. Signs and symptoms may be caused by lung cancer or by other conditions:

- Chest discomfort or pain.
- A cough that does not go away or gets worse over time.
- Trouble breathing.
- Wheezing.
- Blood in sputum (mucus coughed up from the lungs).
- Hoarseness.
- Loss of appetite.
- Feeling very tired.
- Trouble swallowing.
- Swelling in the face and/or veins in the neck.

## Risk factors for lung cancer

Anything that increases your chance of getting a disease is called a **risk factor**. Having a risk factor does not mean that you will get cancer — **not** having risk factors does not mean that you will **not** get cancer. Risk factors for lung cancer include the following:

- Smoking cigarettes, pipes, or cigars, now or in the past. This is the most important risk factor for lung cancer. The earlier in life a person starts smoking, the more often a person smokes, and the more years a person smokes, the greater the risk of lung cancer.
- Being exposed to secondhand smoke.
- Being exposed to asbestos, arsenic, chromium, beryllium, nickel, soot, or tar in the workplace.
- Being exposed to radiation from any of the following:
  - Radiation therapy to the breast or chest.
  - Radon in the home or workplace.

- Imaging tests such as CT scans.
- Atomic bomb radiation.
- Living where there is air pollution.
- Having a family history of lung cancer.
- Being infected with the human immunodeficiency virus (HIV).
- Taking beta carotene supplements and being a heavy smoker.

Older age is the main risk factor for most cancers.

The chance of getting cancer increases as you get older.

When smoking is combined with other risk factors, the risk of lung cancer is increased.

## Types of lung cancer

There are two main types of lung cancer, non-small cell lung cancer and small cell lung cancer.

### There are several types of non-small cell lung cancer.

Each type of non-small cell lung cancer has different kinds of cancer cells. The cancer cells of each type grow and spread in different ways. The types of non-small cell lung cancer are named for the kinds of cells found in the cancer and how the cells look under a microscope:

- **Squamous cell carcinoma:** Cancer that begins in squamous cells, which are thin, flat cells that look like fish scales.
- **Large cell carcinoma:** Cancer that may begin in several types of large cells
- **Adenocarcinoma:** Cancer that begins in the cells that line the alveoli (air sacs) and make substances such as mucus.

Other less common types of non-small cell lung cancer are: pleomorphic, carcinoid tumor, salivary gland carcinoma, and unclassified carcinoma.

### There are two main types of small cell lung cancer.

Types of small cell lung cancer are named for the kinds of cells found in the cancer and how the cells look when viewed under a microscope. The cancer cells of each type grow and spread in different ways. Different lung cancers respond to different treatments.

- Small cell carcinoma (oat cell cancer).
- Combined small cell carcinoma.

### Tests that examine the lungs are used to detect (find) and diagnose lung cancer.

Tests and procedures to detect, diagnose, and stage lung cancer are often done at the same time. Some of the following tests and procedures may be used:

- **Physical exam and history**
- **Laboratory tests:** Medical procedures that test samples of tissue, blood, urine, or other substances in the body. These tests help to diagnose disease, plan and check treatment, or monitor the disease over time.
- **Chest x-ray:** An x-ray of the organs and bones inside the chest. An x-ray is a type of energy beam that can go through the body and onto film, making a picture of areas inside the body.
- **CT scan (CAT scan):** A procedure that makes a series of detailed pictures of areas inside the body,

such as the chest, taken from different angles. The pictures are made by a computer linked to an x-ray machine. A dye may be injected into a vein or swallowed to help the organs or tissues show up more clearly. This procedure is also called computed tomography, computerized tomography, or computerized axial tomography.

- **Sputum cytology:** A procedure in which a pathologist views a sample of sputum (mucus coughed up from the lungs) under a microscope, to check for cancer cells.
- **Thoracentesis:** The removal of fluid from the space between the lining of the chest and the lung, using a needle. A pathologist views the fluid under a microscope to look for cancer cells.
- **Biopsy:** The removal of cells or tissues so they can be viewed under a microscope by a pathologist to check for signs of cancer. A tissue biopsy is almost always required before treatment begins. The different ways a biopsy can be done include the following:
  - **Fine-needle aspiration (FNA) biopsy of the lung:** The removal of tissue or fluid from the lung using a thin needle. A CT scan, ultrasound, or other imaging procedure is used to locate the abnormal tissue (such as a mass or nodule) or fluid in the lung. A small incision may be made in the skin where the biopsy needle is inserted into the abnormal tissue or fluid. A sample is removed with the needle and sent to the laboratory. A pathologist then views the sample under a microscope to look for cancer

cells. A chest x-ray is done after the procedure to make sure no air is leaking from the lung into the chest.

- **Endoscopic Ultrasound:** An endoscopic ultrasound (EUS) is a type of ultrasound that may be used to guide an FNA biopsy of the lung, lymph nodes, or other areas. EUS is a procedure in which an endoscope is inserted into the body. An endoscope is a thin, tube-like instrument with a light and a lens for viewing. A probe at the end of the endoscope is used to bounce high-energy sound waves (ultrasound) off internal tissues or organs and make echoes. The echoes form a picture of body tissues called a sonogram.
- **Bronchoscopy:** A procedure to look inside the trachea and large airways in the lung for abnormal areas. A bronchoscope is inserted through the nose or mouth into the trachea and lungs. A bronchoscope is a thin, tube-like instrument with a light and a lens for viewing. It may also have a tool to remove tissue samples, which are checked under a microscope for signs of cancer.
- **Thoracoscopy:** A surgical procedure to look at the organs inside the chest to check for abnormal areas. An incision (cut) is made between two ribs, and a thoracoscope is inserted into the chest. A thoracoscope is a thin, tube-like instrument with a light and a lens for viewing. It may also have a tool to remove

tissue or lymph node samples, which are checked under a microscope for signs of cancer. In some cases, this procedure is used to remove part of the esophagus or lung. If certain tissues, organs, or lymph nodes can't be reached, a thoracotomy may be done. In this procedure, a larger incision is made between the ribs and the chest is opened.

- **Mediastinoscopy:** A surgical procedure to look at the organs, tissues, and lymph nodes between the lungs for abnormal areas. An incision (cut) is made at the top of the breastbone and a mediastinoscope is inserted into the chest. A mediastinoscope is a thin, tube-like instrument with a light and a lens for viewing. It may also have a tool to remove tissue or lymph node samples, which are checked under a microscope for signs of cancer.
- **Anterior mediastinotomy:** A surgical procedure to look at the organs and tissues between the lungs and between the breastbone and heart for abnormal areas. An incision (cut) is made next to the breastbone and a mediastinoscope is inserted into the chest. A mediastinoscope is a thin, tube-like instrument with a light and a lens for viewing. It may also have a tool to remove tissue or lymph node samples, which are checked under a microscope for signs of cancer. This is also called the Chamberlain procedure.
- **Lymph node biopsy:** The removal of all or part of a lymph node. A pathologist views the tissue under a microscope to look for cancer cells.

One or more of the following laboratory tests may be done to study the tissue samples.

- **Light and electron microscopy:** A laboratory test in which cells in a sample of tissue are viewed under regular and high-powered microscopes to look for certain changes in the cells.
- **Molecular test:** A laboratory test to check for certain genes, proteins, or other molecules in a sample of tissue, blood, or other body fluid. Molecular tests check for certain gene or chromosome changes that occur in non-small cell lung cancer.
- **Immunohistochemistry:** A test that uses antibodies to check for certain antigens in a sample of tissue. The antibody is usually linked to a radioactive substance or a dye that causes the tissue to light up under a microscope. This type of test may be used to tell the difference between different types of cancer.

### **Certain factors affect prognosis (chance of recovery) and treatment options.**

The prognosis (chance of recovery) and treatment options depend on the following:

- The stage of the cancer (the size of the tumor, if the tumor is in one or more areas in the lung, or if it has spread to other places in the body).
- The type of lung cancer.
- Whether the cancer has mutations (changes) in certain genes, such as the epidermal growth factor receptor (EGFR) gene, anaplastic lymphoma kinase (ALK) gene, or others including ROS-1 and BRAF.

- Certain tests can predict if a tumor will respond to newer treatments. One example of this would be PD-L1.
- Whether there are signs and symptoms such as coughing or trouble breathing.
- Your general health.

## Lung cancer and checking for spread of the disease

Cancer can spread through tissue, the lymph system, and the blood:

- **Tissue.** The cancer spreads from where it began by growing into nearby areas.
- **Lymph system.** The cancer spreads from where it began by getting into the lymph system. The cancer travels through the lymph vessels to other parts of the body.
- **Blood.** The cancer spreads from where it began by getting into the blood. The cancer travels through the blood vessels to other parts of the body.

When cancer spreads to another part of the body, it is called metastasis. The metastatic tumor is the same type of cancer as the primary tumor. For example, if lung cancer spreads to the brain, the cancer cells in the brain are actually lung cancer cells. The disease is metastatic lung cancer, not brain cancer.

The process used to find out if cancer has spread within the lungs or to other parts of the body is called staging. It is important to know the stage in order to plan treatment. Some of the tests used to diagnose lung cancer are also used to stage the disease. Other tests and procedures used in the staging process could include:

- **MRI (magnetic resonance imaging):** A procedure that uses a magnet, radio waves, and a computer to make a series of detailed pictures of areas inside the body, such as the brain. This procedure is also called nuclear magnetic resonance imaging (NMRI).
- **CT scan (CAT scan):** A procedure that makes a series of detailed pictures of areas inside the body, such as the brain, abdomen, and lymph nodes, taken from different angles. The pictures are made by a computer linked to an x-ray machine. A dye may be injected into a vein or swallowed to help the organs or tissues show up more clearly. This procedure is also called computed tomography, computerized tomography, or computerized axial tomography.
- **PET scan (positron emission tomography scan):** A procedure to find malignant tumor cells in the body. A small amount of radioactive glucose (sugar) is injected into a vein. The PET scanner rotates around the body and makes a picture of where glucose is being used in the body. Malignant tumor cells show up brighter in the picture because they are more active and take up more glucose than normal cells do. Bright spots that are not cancer can occur, such as with an infection.
- **Bone scan:** A procedure to check if there are rapidly dividing cells, such as cancer cells, in the bone. A very small amount of radioactive material is injected into a vein and travels through the bloodstream. The radioactive material collects in the bones with cancer and is detected by a scanner.

- **Pulmonary function test (PFT):** A test to see how well the lungs are working. It measures how much air the lungs can hold and how quickly air moves into and out of the lungs. It also measures how much oxygen is used and how much carbon dioxide is given off during breathing. This is also called lung function test.
- **Bone marrow aspiration and biopsy:** The removal of bone marrow, blood, and a small piece of bone by inserting a hollow needle into the hipbone or breastbone. A pathologist views the bone marrow, blood, and bone under a microscope to look for signs of cancer.

### The following stages are used for non-small cell lung cancer:

#### Stages I (1) II (2) or III (3)

Stages 1, 2, or 3 describe the involvement of cancer in the layers of the tissue, muscle or lymph node involvement and nearby organs.

#### Stage IV (4)

In stage IV, the tumor may be any size and cancer may have spread to lymph nodes. One or more of the following is true:

- There are one or more tumors in both lungs.
- Cancer is found in fluid around the lungs or the heart.
- Cancer has spread to other parts of the body, such as the brain, liver, adrenal glands, kidneys, or bone.

### Recurrent Lung Cancer

- Recurrent non-small cell lung cancer is cancer that has recurred (come back) after it has been treated. The cancer may come back in the brain, lung, or other parts of the body.

### The following stages are used for small cell lung cancer:

#### Limited-stage small cell lung cancer

- In limited-stage, cancer is in the lung where it started and may have spread to the area between the lungs or to the lymph nodes above the collarbone.

#### Extensive-stage small cell lung cancer

- In extensive-stage, cancer has spread beyond the lung or the area between the lungs or the lymph nodes above the collarbone to other places in the body.

### There are different types of treatments for lung cancer.

Different types of treatments are available for people with lung cancer. Some treatments are standard (the currently used treatment), and some are being tested in clinical trials.

#### Surgery

After the doctor removes all the cancer that is possible at the time of the surgery, some people may be given chemotherapy or radiation therapy to kill any cancer cells that are left. Treatment given before surgery is called neoadjuvant. Treatment given after the surgery, to lower the risk that the cancer will come back, is called adjuvant therapy.

### **Non-small cell lung cancer surgery:**

- **Wedge resection:** Surgery to remove a tumor and some of the normal tissue around it. When a slightly larger amount of tissue is taken, it is called a segmental resection.
- **Lobectomy:** Surgery to remove a whole lobe (section) of the lung.
- **Pneumonectomy:** Surgery to remove one whole lung.
- **Sleeve resection:** Surgery to remove part of the bronchus.

### **Small cell lung cancer surgery:**

Surgery may be used if the cancer is found in one lung and in nearby lymph nodes only. Because this type of lung cancer is usually found in both lungs, surgery alone is not often used. During surgery, the doctor will also remove lymph nodes to find out if they have cancer in them. Sometimes, surgery may be used to remove a sample of lung tissue to find out the exact type of lung cancer.

### **Radiation therapy**

Radiation therapy is a cancer treatment that uses high-energy x-rays or other types of radiation to kill cancer cells or keep them from growing. The way the radiation therapy is given depends on the type and stage of the cancer being treated. It also depends on where the cancer is found.

There are two types of radiation therapy:

- **External radiation therapy** uses a machine outside the body to send radiation toward the cancer.

- **Internal radiation therapy** uses a radioactive substance sealed in needles, seeds, wires, or catheters that are placed directly into or near the cancer.

**Stereotactic body radiation therapy** is a type of external radiation therapy. Special equipment is used to place you in the same position for each radiation treatment. A radiation machine aims a larger than usual dose of radiation directly at the tumor. This will be done over 3 to 5 treatments. By being in the same position for each treatment, there is less damage to nearby healthy tissue. This procedure is also called stereotactic external-beam radiation therapy and stereotaxic radiation therapy.

**Stereotactic radiosurgery** is a type of external radiation therapy used to treat lung cancer that has spread to the brain. A device will be used to keep your head still during the radiation treatment. A machine aims a single large dose of radiation directly at the tumor in the brain. This procedure does not involve surgery. It is also called stereotaxic radiosurgery, radiosurgery, and radiation surgery.

### **Chemotherapy**

Chemotherapy is a cancer treatment that uses drugs to stop the growth of cancer cells, either by killing the cells or by stopping them from dividing. The way the chemotherapy is given depends on the type and stage of the cancer being treated.

- When chemotherapy is taken by mouth or injected into a vein or muscle, the drugs enter the bloodstream and can reach cancer cells throughout the body (systemic chemotherapy).

- When chemotherapy is placed directly into the cerebrospinal fluid, an organ, or a body cavity such as the abdomen, the drugs mainly affect cancer cells in those areas (regional chemotherapy).

### **Targeted therapy**

Targeted therapy is a type of treatment that uses drugs or other substances to attack specific cancer cells. Targeted therapies usually cause less harm to normal cells than chemotherapy or radiation therapy do. Monoclonal antibodies and tyrosine kinase inhibitors are 2 main types of targeted therapy.

- **Monoclonal antibodies**

Monoclonal antibody therapy is a cancer treatment that uses antibodies made in the laboratory from a single type of immune system cell. These antibodies can identify substances on cancer cells or normal substances in the blood or tissues that may help cancer cells grow. The antibodies attach to the substances and kill the cancer cells, block their growth, or keep them from spreading. Monoclonal antibodies are given by infusion. They may be used alone or to carry drugs, toxins, or radioactive material directly to cancer cells.

- **Tyrosine kinase inhibitors**

Tyrosine kinase inhibitors are small-molecule drugs that go through the cell membrane and work inside cancer cells to block signals that cancer cells need to grow and divide. Some tyrosine kinase inhibitors also have angiogenesis inhibitor effects (this means they stop the blood supply to the tumor).

### **Immunotherapy**

Biologic or immunotherapy is a treatment that uses your immune system to fight cancer. Substances made by the body or made in a laboratory are used to boost, direct, or restore the body's natural defenses against cancer. This type of cancer treatment is also called biotherapy or immunotherapy.

### **Endoscopic stent placement**

An endoscope is a thin, tube-like instrument used to look at tissues inside the body. An endoscope has a light and a lens for viewing and may be used to place a stent in a body structure to keep the structure open. An endoscopic stent can be used to open an airway blocked by abnormal tissue.

### **Laser therapy**

Laser therapy is a cancer treatment that uses a laser beam (a narrow beam of intense light) to kill cancer cells.

### **Photodynamic therapy (PDT)**

Photodynamic therapy (PDT) is a cancer treatment that uses a drug and a certain type of laser light to kill cancer cells. A drug that is not active until it is exposed to light is injected into a vein. The drug collects more in cancer cells than in normal cells.

Fiber optic tubes are used to carry the laser light to the cancer cells, where the drug becomes active and kills the cells. Photodynamic therapy causes little damage to healthy tissue.

It is used mainly to treat tumors on the skin or just under the skin or in the lining of internal organs.

When the tumor is in the airways, PDT is given directly to the tumor through an endoscope.

### **Cryosurgery**

Cryosurgery is a treatment that uses an instrument to freeze and destroy abnormal tissue, such as carcinoma in situ. This type of treatment is also called cryotherapy. For tumors in the airways, cryosurgery is done through an endoscope.

### **Electrocautery**

Electrocautery is a treatment that uses a probe or needle heated by an electric current to destroy abnormal tissue. For tumors in the airways, electrocautery is done through an endoscope.

### **Follow-up tests may be needed.**

Some of the tests that were done to diagnose the cancer or to find out the stage of the cancer may be repeated. Some tests will be repeated in order to see how well the treatment is working. Decisions about whether to continue, change, or stop treatment may be based on the results of these tests.

Support is available for coping with changes that may have happened as a result of cancer treatment. Your healthcare team can offer ideas as well as a plan of care for long-term follow-up.

## **Clinical Trials**

Clinical trials are done to find out if new cancer treatments are safe and effective or better than the standard treatment.

People who take part in a clinical trial may receive:

- The standard drugs alone or
- The standard drugs plus the new treatment being studied

Taking part in a clinical trial helps improve the way cancer will be treated in the future. Even when clinical trials do not lead to effective new treatments, they often answer important questions and help move research forward.

Some clinical trials only include people who have not yet received treatment. Other trials test treatments for those whose cancer has not gotten better. There are also clinical trials that test new ways to stop cancer from coming back or reduce the side effects of cancer treatment.

Many of today's standard treatments for cancer are based on clinical trials.  
**Ask if there is a clinical trial right for you.**

My Health Care Team	Contact Information
Surgeon:	
Medical Oncologist:	
Radiation Oncologist:	
Primary Care Doctor:	
Navigator:	
Nurse:	
Registered Dietitian Nutritionist:	
Other:	

**To learn more about lung cancer**

- **American Cancer Society**  
<https://www.cancer.org/>
- **National Cancer Institute**  
<https://www.cancer.gov/>
- **National Comprehensive Cancer Network Guidelines for Patients**  
<https://www.nccn.org/patients/guidelines/cancers.aspx>
- **MedlinePlus**  
<https://medlineplus.gov>

**Common questions**

What does the pathology report say?

What is the stage of my cancer?

What are my goals for treatment?

What are my treatment options?

What kind of support services are available for me about finances, emotions, spiritual questions, etc.?



Adapted from: PDQ Non-Small Cell Lung Cancer Treatment. Bethesda, MD: National Cancer Institute. Updated <05/02/2018>. Available at: <https://www.cancer.gov/types/lung/patient/non-small-cell-lung-treatment-pdq>. Accessed <05/31/2018>.

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