

## Lung Cancer - Treatment Options [1]

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**ON THIS PAGE:** You will learn about the different ways doctors use to treat people with this type of cancer. To see other pages, use the menu on the side of your screen.

This section outlines treatments that are the standard of care (the best proven treatments available) for this specific type of cancer. When making treatment plan decisions, patients are also encouraged to consider clinical trials as an option. A clinical trial is a research study to test a new approach to treatment to evaluate whether it is safe, effective, and possibly better than the standard treatment. Clinical trials may test such approaches as a new drug, a new combination of standard treatments, or new doses of current therapies. Your doctor can help you review all treatment options. For more information, see the [Clinical Trials](#) [3] and [Latest Research](#) [4] sections.

### **Treatment overview**

There are four basic ways to treat lung cancer: surgery, radiation therapy, chemotherapy, and targeted therapy. Each treatment option is described below, followed by an outline of common treatment plans by the type and stage of cancer. Treatment options and recommendations depend on several factors, including the type and stage of cancer, possible side effects, and the patient's preferences and overall health. Your care plan may also include treatment for symptoms and side effects, an important part of cancer care. Take time to learn about all of your treatment options and be sure to ask questions about things that are unclear. Also, talk about the goals of each treatment with your doctor and what you can expect while receiving the treatment. Learn more about [making treatment decisions](#) [5].

### **Surgery**

A surgical oncologist is a doctor who specializes in treating cancer using surgery. For lung cancer, a thoracic surgeon is specially trained to perform lung cancer surgery. The goal of surgery is the complete removal of the lung tumor and the nearby lymph nodes in the chest. The tumor must be removed with a surrounding border or margin of normal lung tissue. A "negative margin" means that when the pathologist examines the lung, or piece of lung that has been removed by the surgeon, no cancer was found in the healthy tissue surrounding the tumor.

The following types of surgery may be used for lung cancer:

**Lobectomy.** The lungs have five lobes, three in the right lung and two in the left lung. For NSCLC, the removal of an entire lobe of the lung in a procedure called a lobectomy is often the most effective type of surgery, even when the lung tumor is very small.

**A wedge.** If the surgeon cannot remove an entire lobe of the lung, the surgeon can remove the tumor, surrounded by a margin of normal lung.

**Segmentectomy.** This is another way to remove the cancer when an entire lobe of the lung cannot be removed. In a segmentectomy, the surgeon removes the portion of the lung where the cancer developed.

**Pneumonectomy.** If the tumor is close to the center of the chest, the surgeon may have to remove the entire lung.

**Radiofrequency ablation.** Radiofrequency ablation (RFA) is the use of a needle inserted into the tumor to destroy the cancer with an electrical current. It is sometimes used for a lung tumor that cannot be removed with the other types of surgery listed above.

The time it takes to recover from lung surgery depends on how much of the lung is removed and the health of the patient before surgery. Talk with your health care team about what to expect before your surgery, including recovery time and possible side effects. Learn more about [cancer surgery](#) [6].

### **Adjuvant therapy**

Adjuvant therapy is treatment that is given after surgery to lower the risk of the lung cancer returning. Adjuvant therapy may include radiation therapy, chemotherapy, and possibly targeted therapy. Each therapy is described below. It is intended to get rid of any lung cancer cells that may still be in the body after surgery. It also can decrease the risk of recurrence, though there is always some risk that the cancer will come back.

Along with staging, other tools can help determine prognosis and help you and your doctor make decisions about whether adjuvant therapy would be helpful in your treatment. The website Adjuvant! Online ([www.adjuvantonline.com](http://www.adjuvantonline.com) [7]) is one tool that your doctor can access to interpret a variety of factors that are important for making treatment decisions. This website should only be used with the help of your doctor.

Read more about [ASCO's recommendations for adjuvant treatment for lung cancer](#) [8]. In addition, ASCO provides several Decision Aids to help patients talk with their doctors about the risks and benefits of chemotherapy after surgery. Consider using one of the following decision aids to start a discussion with your doctor about adjuvant therapy: [stage IB](#) [9], [stage II](#) [10], or [stage III](#) [11].

### **Radiation therapy**

Radiation therapy is the use of high energy x-rays or other particles to destroy cancer cells. If you

need radiation therapy, you will be asked to see a specialist called a radiation oncologist, a doctor who specializes in giving radiation therapy to treat cancer. The most common type of radiation treatment is called external-beam radiation therapy, which is radiation given from a machine outside the body. A radiation therapy regimen (schedule) usually consists of a specific number of treatments given over a set period of time. This can vary from just a few days of treatment to several weeks. When radiation treatment is given using implants, it is called internal radiation therapy, or brachytherapy. However, brachytherapy is rarely used for lung cancer.

Like surgery, radiation therapy cannot be used to treat widespread cancer. Radiation only destroys cancer cells directly in the path of the radiation beam. It also damages the normal cells in its path; for this reason, it cannot be used to treat large areas of the body.

Sometimes, CT scans (see [Diagnosis](#) [12]) are used to plan out exactly where to direct the radiation to lower the risk of damaging healthy parts of the body. This is called intensity modulated radiation therapy (IMRT) or stereotactic body radiation therapy (SBRT). It is not an option for all patients, but it may be used for patients with early disease and small tumors when surgery is not an option.

Patients with lung cancer who receive radiation therapy often experience fatigue and loss of appetite. If radiation therapy is given to the neck or center of the chest, patients may also develop a sore throat and have difficulty swallowing. Patients may also notice skin irritation, similar to sunburn, where the radiation was directed. Most side effects go away soon after treatment is finished.

If the radiation therapy irritates or inflames the lung, patients may develop a cough, fever, or shortness of breath months and sometimes years after the radiation therapy ends. About 15% of patients develop this condition, called radiation pneumonitis. If it is mild, radiation pneumonitis does not need treatment and goes away on its own. If it is severe, a patient may need treatment for radiation pneumonitis with steroid medications, such as prednisone (multiple brand names). Radiation therapy may also cause permanent scarring of the lung tissue near where the original tumor was located. Typically, the scarring does not cause symptoms. However, severe scarring can cause a permanent cough and shortness of breath. For this reason, radiation oncologists carefully plan the treatments using CT scans of the chest to lessen the amount of normal lung tissue exposed to radiation (see above).

Learn more about [radiation therapy](#) [13].

## **Chemotherapy**

Chemotherapy is the use of drugs to destroy cancer cells, usually by stopping the cancer cells' ability to grow and divide. It has been shown to improve both the length and quality of life for people with lung cancer of all stages. Chemotherapy is given by a medical oncologist, a doctor who specializes in treating cancer with medication.

Systemic chemotherapy is delivered through the bloodstream to reach cancer cells throughout the body. Common ways to give chemotherapy include an intravenous (IV) tube placed into a vein using a needle or in a pill or capsule that is swallowed (orally). Most chemotherapy used for lung cancer is given by IV injection.

A chemotherapy regimen usually consists of a specific number of cycles given over a set period of time. A patient may receive one drug at a time or combinations of different drugs at the same time. The type of lung cancer you have (adenocarcinoma or squamous cell carcinoma) will affect which drugs are used for chemotherapy. Newer chemotherapy regimens cause fewer side effects and are as effective as older treatments. ASCO provides treatment recommendations for chemotherapy for lung cancer. Learn more about [adjuvant chemotherapy](#) [8] and [chemotherapy for stage IV lung cancer](#) [14].

The side effects of chemotherapy depend on the individual and the dose used, but they can include fatigue, risk of infection, nausea and vomiting, hair loss, loss of appetite, diarrhea, and hair loss. Nausea and vomiting are often avoidable; learn more about [preventing nausea and vomiting caused by cancer treatment](#) [15]. These side effects usually go away once treatment is finished.

Chemotherapy may also damage normal cells in the body, including blood cells, skin cells, and nerve cells. This may cause low blood counts, an increased risk of infection, hair loss, mouth sores, and/or numbness or tingling in the hands and feet. Your medical oncologist can often prescribe drugs to help relieve many of these side effects. Hormone injections are also used to prevent white and red blood cell counts from becoming too low.

Learn more about [chemotherapy](#) [16] and [preparing for treatment](#) [17]. The medications used to treat cancer are continually being evaluated. Talking with your doctor is often the best way to learn about the medications prescribed for you, their purpose, and their potential side effects or interactions with other medications. Learn more about your prescriptions by using [searchable drug databases](#) [18].

## **Targeted therapy**

Targeted therapy is a treatment that targets the cancer's specific genes, proteins, or the tissue environment that contributes to cancer growth and survival. This type of treatment blocks the growth and spread of cancer cells while limiting damage to healthy cells.

Recent studies show that not all tumors have the same targets. To find the most effective treatment, your doctor may run tests to identify the genes, proteins, and other factors in your tumor. For some lung cancers, abnormal proteins are found in unusually large amounts in the cancer cells. Running tests to find these proteins can help doctors better match each patient with the most effective treatment whenever possible. In addition, many research studies are taking place now to find out more about specific molecular targets and new treatments directed at them. Learn more about [targeted treatments](#) [19].

For lung cancer, the following types of targeted therapy may be used, particularly in [clinical trials](#) [3]. Talk with your doctor about possible side effects for a specific medication and how they can

be managed.

**Anti-angiogenesis therapy** [20]. Anti-angiogenesis therapy is focused on stopping angiogenesis, which is the process of making new blood vessels. Because a tumor needs the nutrients delivered by blood vessels to grow and spread, the goal of anti-angiogenesis therapies is to "starve" the tumor. Bevacizumab (Avastin) is an anti-angiogenic drug given along with chemotherapy for lung cancer. The risk of serious bleeding for patients taking bevacizumab is about 2%. However, it is more common for patients with squamous cell carcinoma, so bevacizumab is usually not recommended for patients with this type of NSCLC.

**Drugs that work on specific mutations in cancer cells.** Researchers have found that drugs that block EGFR may be effective for stopping or slowing the growth of lung cancer.

- Erlotinib (Tarceva) is a drug that blocks the EGFR. This drug has been shown to work better than chemotherapy if the lung cancer has a mutation in the *EGFR* gene. It is approved by the U.S. Food and Drug Administration (FDA) for patients with locally advanced and metastatic NSCLC and as a maintenance therapy for patients with NSCLC that has not grown or spread after at least four cycles of chemotherapy. This medication is a pill that can be taken by mouth. The side effects of erlotinib include a rash that looks like acne, and diarrhea.
- Gefitinib (Iressa) is another drug that blocks the EGFR. This treatment is only available in Europe and Asia.
- Gilotrif (Afatinib) was approved by the FDA in 2013 as an initial treatment for NSCLC. It is a type of drug called a tyrosine kinase inhibitor (TKI) that works by stopping uncontrolled cell growth caused by a mutation in the *EGFR* gene.
- Crizotinib (Xalkori) is another type of targeted therapy approved by the FDA for advanced NSCLC that has a mutation in the *ALK* gene.
- Ceritinib (Zykadia) is an additional targeted therapy for NSCLC with an *ALK* gene mutation. It is approved by the FDA for patients when the cancer worsens while they are receiving crizotinib or if they cannot take crizotinib.

## Combining treatments

Most people with lung cancer receive more than one type of treatment from more than one specialist. This is called a multidisciplinary team [21] approach. For example, chemotherapy can be given before or after surgery or before, during, or after radiation therapy. Patients should have a sense that their doctors have a coordinated plan of care and are working effectively with one another. If patients do not feel that the surgeon, radiation oncologist, and/or medical oncologist are communicating effectively with them or each other about the goals of treatment and the plan of care, patients should discuss this with their doctors or seek additional opinions before treatment.

## Getting care for symptoms and side effects

Cancer and its treatment often cause side effects. In addition to treatment to slow, stop, or eliminate the cancer, an important part of cancer care is relieving a person's symptoms and side effects. This approach is called palliative or supportive care, and it includes supporting the patient with his or her physical, emotional, and social needs.

Palliative care can help a person at any stage of illness. People often receive treatment for the cancer and treatment to ease side effects at the same time. In fact, patients who receive both often have less severe symptoms, better quality of life, and report they are more satisfied with treatment.

Palliative treatments vary widely and often include medication, nutritional changes, relaxation techniques, and other therapies. You may also receive palliative treatments similar to those meant to eliminate the cancer, such as chemotherapy, surgery, and radiation therapy. Talk with your doctor about the goals of each treatment in your treatment plan.

The following treatments may be given to help relieve the symptoms of lung cancer:

- A tumor in the chest that is bleeding or blocking the lung passages can be shrunk with radiation therapy.
- During a bronchoscopy (See [Diagnosis](#) [12]), lung passages blocked by cancer can be opened to improve breathing.
- A surgeon can use a laser to burn away a tumor or place a stent to prop open an airway.
- Medications are used to treat cancer pain. Most hospitals and cancer centers have pain control specialists who provide pain relief, even for very severe cancer pain. Many drugs used to treat cancer pain, especially morphine, can also relieve shortness of breath caused by cancer. Learn more about [managing cancer pain](#) [22].
- Medications can be used to suppress cough, open closed airways, or reduce bronchial secretions.
- Prednisone or methylprednisolone (multiple brand names) can reduce inflammation caused by lung cancer or radiation therapy and improve breathing.
- Extra oxygen from small, portable tanks can help make up for the lung's reduced ability to extract oxygen from the air.
- Medications are available to strengthen bones, lessen bone pain, and help prevent future bone metastases.
- Appetite stimulants and nutritional supplements can improve appetite and reduce weight loss.

Before treatment begins, talk with your health care team about the possible side effects of your specific treatment plan and supportive care options. And during and after treatment, be sure to tell your doctor or another health care team member if you are experiencing a problem so it is addressed as quickly as possible. Learn more about [palliative care](#) [23].

### **Treatment of NSCLC by stage**

**Stage I and II.** In general, stage I and stage II NSCLC are treated with surgery. Surgeons cure many patients with an operation. Before or after surgery, a patient may be referred to a medical oncologist. Some patients with large tumors or signs that the tumor has spread to the lymph nodes may benefit from chemotherapy before the surgery, called neoadjuvant chemotherapy or induction chemotherapy, or adjuvant chemotherapy to reduce the chance the cancer will return. Radiation therapy may be used to treat and cure a lung tumor when surgery is not recommended.

**Stage III.** Stage III NSCLC has spread to the point that surgery or radiation therapy alone is usually not enough to cure the disease for most people. Patients with stage III disease also have

a high risk of the cancer returning, either in the same place or distantly, even after successful surgery or radiation therapy. For this reason, doctors generally do not recommend immediate surgery, and sometimes suggest chemotherapy before surgery.

After chemotherapy, patients with stage III NSCLC may still have surgery, especially if chemotherapy is effective in shrinking the cancer. However, some patients with stage III NSCLC do not receive surgery. Instead, they may be given a combination of chemotherapy and radiation therapy. Chemotherapy may be given either before or at the same time as the radiation therapy. This method has shown to improve the ability of radiation therapy to shrink the cancer and to lower the risk of the cancer returning.

Chemotherapy given at the same time as radiation therapy is more effective than chemotherapy given before radiation therapy, but causes more side effects. Patients who have received both chemotherapy and radiation therapy for stage III disease may still go on to have surgery. However, there is debate among doctors whether surgery is needed for patients when radiation therapy has worked well, and if radiation therapy is needed in patients whose cancer disappears after chemotherapy.

For most patients with stage III NSCLC, the tumor is unresectable, meaning it cannot be removed with surgery. This may be because the surgeon feels that an operation would be too risky, or that the tumor cannot be removed completely. For patients with unresectable NSCLC, with no signs of spread of cancer to distant sites or to the fluid around the lung, a combination of chemotherapy and radiation therapy can still be used to try to eliminate the cancer.

**Stage IV NSCLC.** Patients with stage IV NSCLC typically do not receive surgery or radiation therapy. Occasionally, doctors may recommend surgery for a brain or adrenal gland metastasis if that is the only place the cancer has spread. Radiation therapy can also be used to treat a metastasis located in only one area, such as the brain. However, patients with stage IV disease have a very high risk of the cancer spreading or growing in another location. Most patients at this stage of NSCLC receive only chemotherapy.

The goals of chemotherapy are to shrink the cancer, relieve discomfort caused by the cancer, prevent the cancer from spread further, and lengthen a patient's life. Chemotherapy can rarely make metastatic lung cancer disappear. However, doctors know from experience that the cancer will usually return. Therefore, patients with stage IV disease are never considered "cured" of their cancer no matter how well chemotherapy works. Treatment often continues as long as it is controlling the cancer's growth. Chemotherapy has been proven to improve both length and quality of life for patients with stage IV NSCLC. If the cancer worsens or causes too many severe side effects, the treatment may be stopped, and patients would continue to receive palliative care.

To help patients talk with their doctor about chemotherapy for stage IV NSCLC, ASCO has created several decision aids. These tools provide information on the risks and benefits of chemotherapy, help for thinking through the decision, and other issues for patients to consider. Use these decision aids to begin a discussion with your doctor: [First-line chemotherapy](#) [24], [second-line chemotherapy](#) [25], [second-line or third-line chemotherapy with erlotinib](#) [26], or [third-line or fourth-line chemotherapy](#) [27].

## **Treatment of small cell lung cancer**

As with NSCLC, the treatment of small cell lung cancer depends on the stage. Small cell lung cancer spreads quickly, so chemotherapy is the primary treatment for all patients. You may hear your doctor refer to limited stage, which means there are no signs that the cancer has spread, or extensive stage, which means that the cancer has spread, to describe your small cell lung cancer.

The most commonly used chemotherapy regimen is etoposide (Toposar, VePesid, Etopophos) plus cisplatin (Platinol) or carboplatin (Paraplatin). For patients with limited stage small cell lung cancer, chemotherapy plus radiation therapy to the chest is given twice a day. Radiation therapy is best when given during the first or second month of chemotherapy. Patients with extensive stage cancer receive chemotherapy for three to six months.

Surgery is rarely used for patients with small cell lung cancer and is only considered for patients with very early-stage disease, such as cancer in a small lung nodule. In those situations, chemotherapy, with or without radiation therapy, is given after surgery.

In patients whose cancer has shrunk after chemotherapy, radiation therapy to the head lessens the risk that the cancer will spread to the brain. This is called prophylactic cranial irradiation (PCI), and it has been shown to lengthen the lives of these patients.

Like patients with later-stage NSCLC, patients with small cell lung cancer of any stage face the risk that their cancer can return, even when its growth is controlled. All patients with small cell lung cancer should have regular follow-up care with their doctors, including x-rays, scans, and check-ups.

## **Metastatic lung cancer**

If cancer has spread to another location in the body, it is called metastatic cancer. Patients with this diagnosis are encouraged to talk with doctors who are experienced in treating this stage of cancer, because there can be different opinions about the best treatment plan. You may want to seek a [second opinion](#) [28] before starting treatment so you are comfortable with the treatment plan chosen. This discussion may include [clinical trials](#) [3].

Chemotherapy is not as effective as radiation therapy or surgery to treat lung cancer that has spread to the brain. For this reason, lung cancer that has spread to the brain is treated with radiation therapy, surgery, or both. Most patients with brain metastases from lung cancer receive radiation therapy to the entire brain. This can cause side effects such as hair loss, fatigue, and redness of the scalp. With a small tumor, a type of radiation therapy called stereotactic radiosurgery can focus radiation only on the tumor in the brain and lessen the side effects.

Supportive care will also be important to help relieve symptoms and side effects. Radiation therapy or surgery may also be used to treat metastases that are causing pain or other symptoms. Bone metastases that weaken major bones can be treated with surgery, and the bones can be reinforced using metal implants.



For most patients, a diagnosis of metastatic cancer is very stressful and, at times, difficult to bear. Patients and their families are encouraged to talk about the way they are feeling with doctors, nurses, social workers, or other members of the health care team. It may also be helpful to talk with other patients, including through a support group.

### **Remission and the chance of recurrence**

A remission is when cancer cannot be detected in the body and there are no symptoms. This may also be called "no evidence of disease" or NED.

A remission can be temporary or permanent. This uncertainty leads to many survivors feeling worried or anxious that the cancer will come back. While many remissions are permanent, it's important to talk with your doctor about the possibility of the cancer returning. Understanding the risk of recurrence and the treatment options may help you feel more prepared if the cancer does return. Learn more about [coping with the fear of recurrence](#) [29].

If the cancer does return after the original treatment, it is called recurrent cancer. It may come back in the same place (called a local recurrence), nearby (regional recurrence), or in another place (distant recurrence).

When this occurs, a cycle of testing will begin again to learn as much as possible about the recurrence, including whether the cancer's stage has changed. After testing is done, you and your doctor will talk about your treatment options. Often the treatment plan will include the therapies described above such as surgery, chemotherapy, and radiation therapy, but they may be used in a different combination or given at a different pace. Your doctor may also suggest clinical trials that are studying new ways to treat this type of recurrent cancer.

People with recurrent cancer often experience emotions such as disbelief or fear. Patients are encouraged to talk with their health care team about these feelings and ask about support services to help them cope. Learn more about [dealing with cancer recurrence](#) [30].

### **If treatment fails**

Recovery from cancer is not always possible. If treatment is not successful, the disease may be called advanced or terminal cancer.

This diagnosis is stressful, and this is difficult to discuss for many people. However, it is important to have open and honest conversations with your doctor and health care team to express your feelings, preferences, and concerns. The health care team is there to help, and many team members have special skills, experience, and knowledge to support patients and their families. Making sure a person is physically comfortable and free from pain is extremely important.

Patients who have advanced cancer and who are expected to live less than six months may want to consider a type of palliative care called hospice care. Hospice care is designed to provide the best possible quality of life for people who are near the end of life. You and your family are encouraged to think about where you would be most comfortable: at home, in the hospital, or in a hospice environment. Nursing care and special equipment can make staying at home a workable

alternative for many families. Learn more about [advanced cancer care planning](#) [31].

After the death of a loved one, many people need support to help them cope with the loss. Learn more about [grief and loss](#) [32].

*The next section helps explain clinical trials, which are research studies. Use the menu on the side of your screen to select About Clinical Trials, or you can select another section, to continue reading this guide.*

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**Links:**

- [1] <http://www.cancer.net/cancer-types/lung-cancer/treatment-options>
- [2] <http://www.cancer.net/about-us>
- [3] <http://www.cancer.net/node/19156>
- [4] <http://www.cancer.net/node/19160>
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