

Fourth Edition

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Lung Cancer

A TREATMENT GUIDE FOR PATIENTS AND THEIR FAMILIES

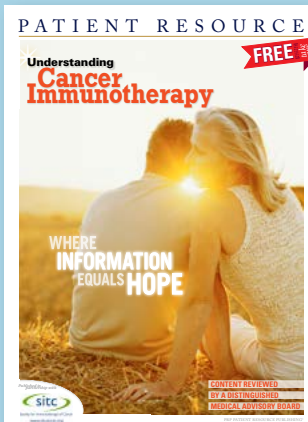
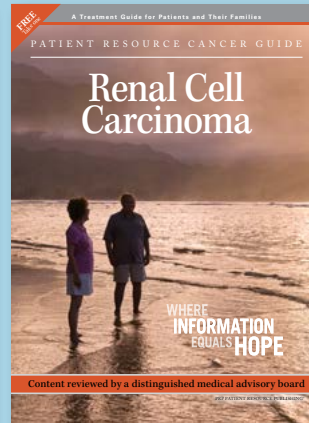
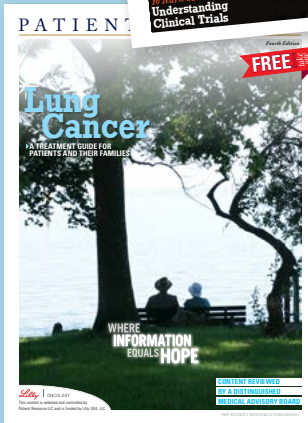
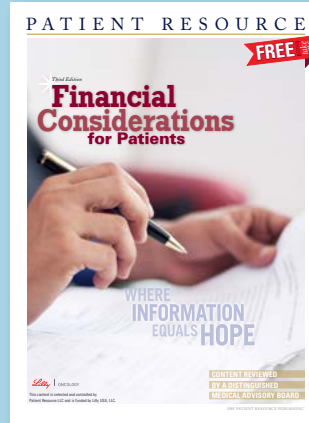
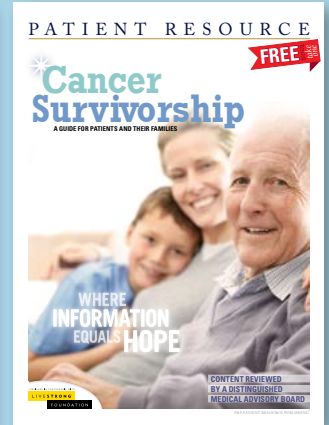
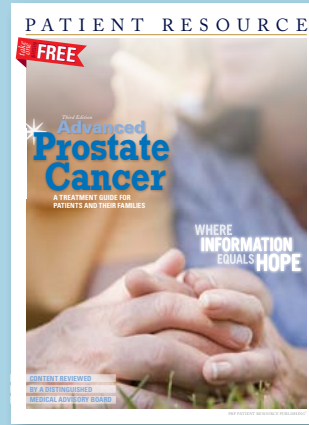
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PATIENT RESOURCE CANCER GUIDE

Lung Cancer

Fourth Edition

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An estimated 224,210 new cases of lung cancer will be diagnosed in 2014, making lung cancer one of the most common types of cancer in both men and women in the United States. The rate of new cases of lung cancer varies according to gender and race/ethnicity, but the disease occurs more often in men than women and occurs most frequently in black and white men. However, advances in technology and knowledge about the disease have led to new treatment options that may be a possibility for many people.

How lung cancer develops

Lung cancer is the uncontrolled growth of abnormal cells lining the airways (bronchi) of the lung (Figure 1). Researchers believe lung cancer develops slowly over the course of many years after exposure to cancer-causing substances (carcinogens), resulting in more and more genetic abnormalities that accumulate in the cells. Over time, the abnormal cells become malignant (cancerous), divide and spread.

The overwhelming cause of lung cancer is the use of tobacco products such as cigarettes, pipes or cigars. The earlier in life a person starts smoking, the more packs of

cigarettes a person smokes, and the more years a person smokes, the greater the chance for lung cancer. Once a person stops smoking, the risk becomes lower each year, but the risk is still higher than for people who have never smoked.

As many as one in five lung cancers develop in people who have never smoked, most often women. In some of these cases, unknown factors are responsible. Exposure to secondhand smoke, asbestos and radon also increase the threat of lung cancer, and family history and ethnicity are other factors as well.

Even though lung cancer grows slowly, it spreads through the bloodstream and is

difficult to detect early, primarily because there are no early symptoms of lung cancer. In addition, many of the first symptoms, such as a cough, are also symptoms of chronic lung disease caused by tobacco products. This means there's nothing to alert a person to seek medical care.

However, a method to screen for lung cancer – low-dose spiral computerized tomography (CT) – now exists and is recommended for people at high risk for lung cancer. A person is at high risk if he or she is 55 to 74 years old, has smoked the equivalent of a pack of cigarettes daily for 30 or more years, and has stopped smoking fewer than 15 years previously. A large study showed that among a group of high-risk people, fewer people died of lung cancer when they were screened with low-dose spiral CT compared with people who were screened with standard chest X-rays. The International Association for the Study of Lung Cancer (IASLC) and other organizations suggest that high-risk individuals should discuss a screening CT scan with their doctor.

Types of lung cancer

Lung cancer is classified into four main types: small cell carcinoma, large cell carcinoma, adenocarcinoma and squamous cell carcinoma (see Table 1). The type is determined by the pathologist – a doctor who specializes in the examination of tissue to determine disease – who looks at a sample of tumor tissue under a microscope and sometimes uses special stains to allow some otherwise transparent tissue sections to be visible.

Small cell lung cancer most often spreads to other sites and may grow much faster than the other types. Because of this, small cell carcinoma is sometimes distinguished from the three other types, which are often classified together as “non-small cell lung cancer.” Many doctors no longer use the term non-small cell lung cancer because optimal treatment now depends on the specific type of cancer. (For easier reading, the term “non-small cell lung cancer” is used throughout this guide.) In addition to differences according to the type of lung cancer, different genetic abnormalities may drive the growth of

TABLE 1 | CLASSIFICATION OF LUNG CANCER

Type	Frequency (among all lung cancers)	Where it's usually found	Comments
Non-small cell lung cancer (NSCLC)	80-85%	(See subtypes)	The exact type of NSCLC must now be distinguished for optimal therapy.
• Adenocarcinoma	35-50%	Glands of the lungs that produce mucus; often in the outer edges of the lung	This is the most common type of lung cancer overall, in women, and in people who have never smoked. Type most often associated with identified genetic abnormalities.
• Squamous cell carcinoma	20-25%	Lining of the bronchial tubes; usually in the center parts of the lung	This type is highly associated with tobacco smoking.
• Large cell carcinoma	10-15%	Can occur anywhere in the lung but usually near the surface at the outer edges of the lung	This type grows more quickly than the other two subtypes.
Small cell lung cancer (SCLC)	15-20%	In the center of the lung, with invasion of the hilar and mediastinal areas and with disease in nearby lymph nodes	The cancer cells multiply rapidly and form large tumors that can spread throughout the body; current and former smoking is almost always the cause.

lung cancer. The type of cancer is further defined by the presence or absence of the specific genetic abnormalities.

The most common type of lung cancer is adenocarcinoma, followed by squamous cell carcinoma, small cell carcinoma and large cell carcinoma. All types are caused primarily by cigarette smoking, but adenocarcinoma is the type that occurs most often in people who have never smoked.

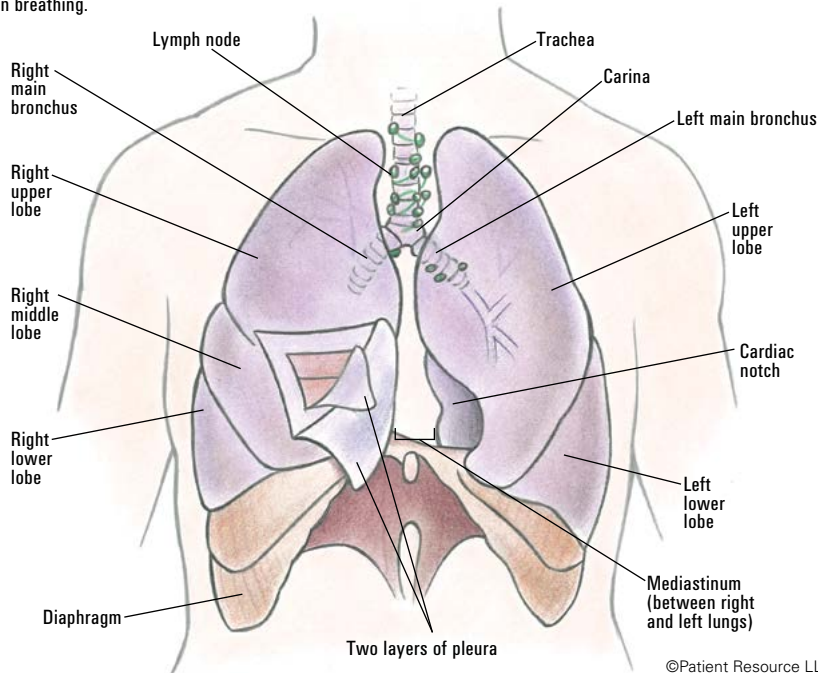
About this guide

This publication is primarily for men and women who have had a suspicious mass detected on an imaging study or have had lung cancer diagnosed. On these pages you'll find information on how doctors diagnose and stage lung cancer and work within a team to plan treatment designed to achieve the best outcomes possible for your particular tumor. You will also learn about various treatment options, potential side effects of treatment, management of lung cancer symptoms, and how to take control of your life after a lung cancer diagnosis. Throughout the guide you'll also be directed to websites with more details to help you better understand lung cancer and its treatment. ■

▼ | FIGURE 1 | ANATOMY OF THE LUNGS

The lungs are spongy, air-filled organs located on either side of the chest (thorax). The right lung has three lobes, and the left lung has two lobes. Air enters the lungs through the nose and mouth, moving through the windpipe (trachea) and into the airways (bronchi) in the lung. These airways divide into smaller branches, called bronchioles, and end in microscopic air sacs (alveoli), where oxygen and carbon dioxide are exchanged.

The lungs are covered by a thin layer of tissue called the visceral pleura. Another layer of this same kind of tissue lines the inside of the chest cavity; this layer is called the parietal pleura. Fluid between these two tissue layers acts as a lubricant as the lungs expand and contract during breathing. The diaphragm is a muscle at the base of the lungs that helps in breathing.



FIVE THINGS YOU SHOULD KNOW ABOUT LUNG CANCER

1

Not all lung cancers are the same. As with many other types of cancer, lung cancer is not just one disease. Instead, there are different types of lung cancer, classified according to the specific tissue in the lung in which they develop. Determining the classification of lung cancer and the stage of disease is important because treatment is selected according to the type and stage. Learn about the diagnosis and staging of lung cancer beginning on page 4.

2

You don't have to smoke to get lung cancer. Although the overwhelming cause of lung cancer is smoking, not all people with lung cancer are smokers. In fact, the most common type of non-small cell lung cancer (adenocarcinoma) occurs most often in people who have never smoked. You may not have to smoke to get lung cancer, but if you do smoke, you have to quit! Quitting is not easy and it may take several attempts before you're successful, but you can get help from several resources. Ask your doctor for help.

3

Lung cancer treatment is getting personal. As researchers discover more information about how lung cancer develops, they are finding genetic abnormalities that can be targets for newer types of drugs. These genetic abnormalities are leading the way for personalized treatment of lung cancer, with treatment selected according to the specific characteristics of an individual tumor. Personalized treatment is also referred to as precision treatment.

4

Side effects of treatment can be alleviated. Treatments for lung cancer may cause side effects, but many ways to manage side effects now exist. Talk to your doctor about the potential side effects of your treatment options and ask about ways to prevent these side effects. During treatment, tell your doctor or other member of your health care team about symptoms you have so that they can be managed before they become severe.

5

You can take control. A diagnosis of lung cancer is overwhelming, and it's easy to feel as if your life is out of control. But you have the power to overcome many challenges of lung cancer. Don't be afraid to ask your doctor about treatment options and to state your preferences. Do whatever it takes to help you heal and feel physically and emotionally healthy, whether it's meditation, yoga, relaxation techniques, spirituality or counseling. Enjoy your favorite activities. Live every day to its fullest.

Several tests are available to help your doctors learn more about your lung cancer. These tests have two important purposes: First, they provide details that help your doctors make a specific diagnosis about the type of lung cancer you have. Second, the tests offer information that helps doctors assign a stage to the lung cancer. An accurate diagnosis and stage are essential for determining the best treatment options, which may spare you from treatment unlikely to be effective. Learn how these tests are done and what you can expect (Table 1), and ask your doctor any additional questions you may have.

Diagnostic imaging studies

Imaging studies are primarily used to help define the size, shape and location of the tumor. They are also useful in assessing other parts of the body to see if the cancer has metastasized (spread beyond the lung), which aids in defining the stage of disease.

Chest X-ray

Standard chest X-rays are often the initial type of imaging study done because of their convenience and low cost. A chest X-ray is usually the first imaging study to show an area on the lung suspected to be cancer.

Computerized tomography (CT)

CT scans produce three-dimensional, cross-sectional X-ray images, so they can provide more precise details than a standard X-ray. CT scans provide an excellent assessment of the size of lymph nodes, but the size does not always indicate whether or not the nodes are involved with cancer. Because of this, other studies may be done to evaluate the lymph nodes.

Positron emission tomography (PET)

PET images are not as finely detailed as CT images, but they can provide helpful information, especially if you have early-stage lung cancer, because the scan may show that the cancer has spread to other sites. PET scans are particularly useful if your doctor thinks cancer may have spread beyond the lung but does not know where. PET scans are also helpful in distinguishing cancerous lesions from benign (noncancerous) lesions.

PET scans are not helpful, however, for finding metastasis to the brain.

CT/PET

In diagnosing lung cancer, PET scans are used most often in combination with a CT scan, with the two tests done in the same testing session. The use of both tests provides a more complete picture for the radiologist, who can compare areas of higher radioactivity on the PET scan with the detailed appearance of the same area on the CT scan.

Magnetic resonance imaging (MRI)

MRI is most valuable for detecting metastasis in the brain or spinal cord. A brain MRI is commonly done in the initial staging of lung cancer and may also be done to look for metastasis in other parts of the body.

Bone scan

A bone scan helps determine whether lung cancer has spread to bone. This test is often unnecessary because PET scans, which are more commonly used for people with lung

TABLE 1 | DIAGNOSTIC AND STAGING PROCEDURES: WHAT TO EXPECT

Imaging study or procedure	How it's done
Standard chest X-ray	A chest X-ray is usually taken with the person standing against a plate on which the images are recorded. You must keep still and hold your breath for a few seconds when the X-ray picture is taken.
Computerized tomography (CT)	A CT scanner takes many pictures of organs as the table on which you're lying moves slowly through the scanner. You will need to lie very still while the images are being made. A contrast material (also referred to as dye) may be injected into a vein in your arm or given to you by mouth before the test to enhance the quality of the images. This contrast material may cause you to feel a brief sense of warmth or flushing in your body; this feeling is normal. If you are to receive contrast material, your doctor will order a blood test to check your kidney function to prevent possible kidney problems related to the contrast material. CT scans can be taken of portions of your body, such as your chest, abdomen or pelvis. When combined with PET scans, the entire body is usually scanned.
Positron emission tomography (PET)	A small amount of a radioactive glucose (sugar) is injected into a vein. Lung cancer cells use a high amount of energy and will absorb greater amounts of the radioactive sugar than normal tissue cells do. A special camera detects any increased amounts of radioactive sugar and provides an image of the tumor or an area of metastasis.
Magnetic resonance imaging (MRI)	Images are produced through radio waves and a powerful magnet linked to a computer. Although MRI is painless, you will need to lie still on a table within the tube of the MRI machine, which makes loud, repetitive clicking noises. Tell your doctor if you are uncomfortable in enclosed spaces so that steps can be taken to manage your anxiety. Contrast material may be used to enhance the images. Although any part of the body can be scanned, the brain is the most common site scanned to stage lung cancer.
Bone scan	A small amount of a low-level radioactive substance is injected into a vein in your arm. This radioactive substance collects in areas of metastatic disease in bone. You will then lie on a table for about 30 minutes, and a special camera will record images of areas with an increased amount of the radioactive substance. Most of the substance will be eliminated from your body within one day and will be completely gone within two days.
Bronchoscopy	A thin, tube-like instrument (bronchoscope) is inserted through the nose or mouth into the trachea (windpipe) and lungs. The bronchoscope has a light and lens that enable the doctor to examine the inside of the trachea, air passages (bronchi) and lungs. Tiny tools can also be inserted through the bronchoscope to obtain samples for pathologic evaluation. You will be lightly sedated to keep you comfortable during the procedure.
Endobronchial ultrasound	A bronchoscope is inserted, and a small, special ultrasound probe is passed through the bronchoscope. The ultrasound gives off sound waves, which provide images of the lungs and mediastinal area. Tiny tools can also be inserted through the bronchoscope to obtain samples for pathologic evaluation. You will be lightly sedated or given general anesthesia to keep you comfortable during the procedure.
Mediastinoscopy	A very small incision is made just above the breastbone, and a thin tube (mediastinoscope) is inserted into the incision. A tiny camera on the tube sends pictures of the mediastinal area and lungs to a video screen that the doctor can see. The video images can also help your doctor obtain samples from any areas that look abnormal. General anesthesia is usually given to keep you asleep and without pain during the procedure.



cancer, can also show if cancer has spread to bone. A bone scan is usually done only if a person has signs and symptoms of metastasis.

Staging procedures

Staging procedures allow the doctor to view the lungs and/or surrounding area and to obtain a biopsy sample from the tumor and/or nearby lymph nodes or other tissue.

Bronchoscopy

A bronchoscopy allows your doctor to look inside the lungs and the large airways in the lungs (bronchi) for abnormal areas. Tiny tools can be inserted into the bronchoscope to obtain samples of tissue or fluid.

Endobronchial ultrasound

Done using a bronchoscope, this is a newer technique that offers a way to examine the area of the chest between the lungs and the heart (mediastinum) without the need for incisions. The images provided by the ultrasound instrument help guide the doctor in removing samples for evaluation. This procedure also allows the doctor to remove tissue from the mediastinal lymph nodes to see if cancer has spread there. The tissue samples removed with this technique are relatively small, however, which can be a problem. Your doctor will need enough tissue to test for genetic abnormalities, which may be important for selecting appropriate treatment.

▼ **TABLE 2 | GENETIC ABNORMALITIES IN NON-SMALL CELL LUNG CANCER**

Genetic abnormality	Most commonly found	Type of non-small cell lung cancer	Advisability of testing
EGFR mutation	Women People who have never smoked People of Asian descent Light smokers	All types, but most often in adenocarcinoma and rarely in squamous cell carcinoma	Recommended
ALK rearrangement	Younger people People who never smoked or light smokers	Adenocarcinoma	Recommended
KRAS mutation	Current or former smokers	All types, but most often in adenocarcinoma and less often in squamous cell carcinoma	Increasingly being done in many medical centers; may help to select patients who do not require further testing

Mediastinoscopy

Mediastinoscopy is considered to be the best method for evaluating lymph nodes in the mediastinum, but because it requires general anesthesia, it's usually performed only in patients with early-stage disease. The doctor can remove lymph nodes through small cuts made just above the breastbone or on the left side of the chest next to the breastbone. It's necessary to evaluate these nodes when they appear enlarged on CT scans or have high areas of radioactivity on a PET scan. This evaluation – called mediastinal staging – is important because a small tumor may appear to be early-stage disease, but if the mediastinal lymph nodes contain cancer cells, the cancer is actually a later stage, which means the treatment approach should be different.

Evaluation of tissue samples

Samples of tissue obtained during these procedures are examined by a pathologist to see if cancer cells are present and, if so, to determine the type of cancer. The pathologist will also record the size and location of the tumor, the number of lymph nodes with cancer cells, and other important facts about the cancer. In some instances, the pathologist may not be able to identify the type because the tissue sample is too small. When this happens, another biopsy may be necessary. The pathologic evaluation of biopsy samples offers the most valuable information for the diagnosing and staging of lung cancer.

Testing for genetic abnormalities

As researchers learn more, they have discovered three genetic abnormalities that may affect how non-small cell lung cancers grow and, perhaps more importantly, how they respond to some types of treatment. These three abnormalities are mutually exclusive; that is, none is found with another in the same tumor. The genetic abnormalities differ according to the types of people and lung cancers in which they are most often found (Table 2).

Determining if any of these three genetic abnormalities is present has become an important part of diagnosing non-small cell lung cancer, especially for people with advanced disease, as treatment options may differ depending on the presence or absence of a genetic abnormality. Talk to your doctor about whether your tumor specimen should be tested for genetic abnormalities, which is also known as molecular testing. ■

ADDITIONAL RESOURCES

American Cancer Society: www.cancer.org

American College of Chest Physicians: www.chestnet.org

Living with Lung Cancer

American Society of Clinical Oncology (patient website): www.cancer.net

International Association for the Study of Lung Cancer: www.iaslc.org

Lung Cancer Online Foundation: www.lungcanceronline.org

Tests and Procedures

National Cancer Institute: www.cancer.gov
Non-Small Cell Lung Cancer Treatment (PDQ)



As with all cancers, identifying the stage of lung cancer is necessary to determine the prognosis (outcome) and to plan treatment. Lung cancer

is usually staged twice. First, your doctor will evaluate the results of your physical exam and imaging tests and assign a clinical stage. Then, after a staging procedure or surgery is done, a pathologist will examine tissue taken from the tumor and nearby lymph nodes and assign a pathologic stage, which provides more details about the cancer. Because the pathologic stage is a more accurate description of the tumor, it is the key to selecting the best treatment options and determining the prognosis.

Your doctor and the pathologist will classify the stage of the lung cancer according to the tumor, node, metastasis (TNM) system developed by the American Joint Committee on Cancer (AJCC) and the Union for International Cancer Control (UICC). This system is based on data from around the world collected by the International Association for the Study of Lung Cancer (IASLC).

With this system, the tumor (T) is classified according to its size and location, the lymph nodes (N) are classified according to whether cancer cells are found in them, and distant metastasis (M) is defined as being absent or present (cancer has spread to other parts of the body). Once a lung cancer has been classified with the TNM system, an overall stage is assigned.

The TNM classification and staging system for lung cancer was updated in 2010, and both non-small cell and small cell lung cancers are staged according to the updated system (Tables 1 and 2, Figure 1). Talk with your doctor to make sure that your lung cancer is staged according to the updated system, as it can provide a more accurate prediction of outcome. In addition, the treatment options available to you may be different with the updated staging system.

Some doctors still define the stage of small cell cancer as simply either limited-stage or extensive-stage. With limited-stage small cell lung cancer, cancer is found in only one lung and may also be found in lymph nodes in the chest and above the clavicle (collarbone) on either side. With extensive-stage small cell lung cancer, cancer has spread to the other

lung, to distant lymph nodes or to distant organs. Treatment is often selected according to these two stages, although the TNM classification

provides more detailed information about the predicted outcome and is therefore a greater factor in decision-making. ■

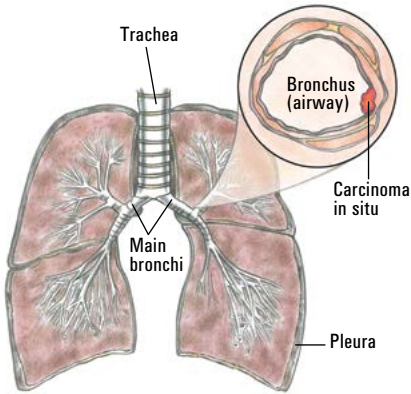
TABLE 1 | AJCC SYSTEM FOR CLASSIFYING LUNG CANCER

Classification	Definition
Tumor (T)	
Tx	Primary tumor cannot be assessed OR there is evidence of cancer according to laboratory studies but no tumor seen on imaging studies or with bronchoscopy
T0	No evidence of primary tumor
Tis	Carcinoma in situ (in place)
T1	Tumor is 3 centimeters (approximately 1 inch) or smaller in greatest dimension, surrounded by lung or visceral pleura (lining covering the outside of the lung), with no evidence of tumor in the main bronchus (airway)
T1a	Tumor is 2 cm (approximately 3/4 inch) or less in greatest dimension
T1b	Tumor is more than 2 cm in greatest dimension but not more than 3 cm in greatest dimension
T2	Tumor is more than 3 cm but not more than 7 cm (approximately 2-3/4 inches); or tumor has any of the following features: <ul style="list-style-type: none"> • Cancer has invaded the main bronchus, 2 cm or more away from the carina (the ridge at the lower end of the trachea) • Cancer has invaded the visceral pleura • The tumor involves atelectasis (collapse of part of the lung) or obstructive pneumonitis (inflammation of lung tissue) that extends to the hilar region but does not involve the entire lung
T2a	Tumor is more than 3 cm but not more than 5 cm (approximately 2 inches) in greatest dimension
T2b	Tumor is more than 5 cm but not more than 7 cm in greatest dimension
T3	Tumor is more than 7 cm, or directly invades any of the following: chest wall, diaphragm, phrenic nerve, mediastinal pleura, parietal pericardium; or the tumor is in the main bronchus less than 2 cm away from the carina but has not invaded the carina; or associated atelectasis or obstructive pneumonitis of the entire lung or separate tumor nodule(s) in the same lobe as the primary
T4	Tumor of any size has invaded any of the following: mediastinum, heart, great vessels, trachea, recurrent laryngeal nerve, esophagus, vertebral body, carina; OR presence of separate tumor nodule(s) in a different lobe of the lung with the primary tumor
Nodes (N)	
Nx	Regional lymph nodes cannot be assessed
N0	Cancer has not spread to any regional lymph nodes
N1	Cancer cells are found in the peribronchial and/or hilar lymph nodes and intrapulmonary nodes on the same side as the lung with the primary tumor
N2	Cancer cells are found in the mediastinal and/or subcarinal lymph nodes on the same side as the lung with the primary tumor
N3	Cancer cells are found in the mediastinal or hilar lymph nodes on the opposite side as the lung with the primary tumor; or cancer cells are found in the scalene or supraclavicular lymph node(s) on the same or opposite side as the lung with the primary tumor
Metastasis (M)	
M0	Cancer has not yet spread from the primary tumor
M1	Cancer has spread from the primary tumor
M1a	A separate tumor nodule(s) is found in a lobe of the lung on the opposite side from the lung with the primary tumor; tumor has pleural nodules or malignant pleural or pericardial effusion
M1b	Cancer has spread to distant sites in the body

▼ **FIGURE 1 | STAGES OF LUNG CANCER**

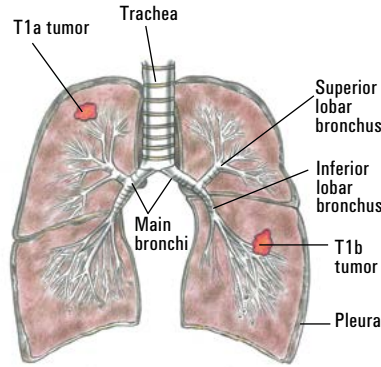
Stage 0

Carcinoma in situ (a cluster of malignant cells that has not invaded surrounding tissue or spread elsewhere).



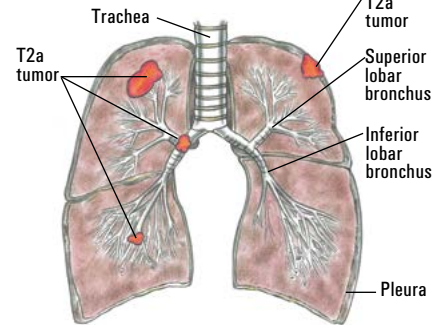
Stage IA

Tumor is up to 3 centimeters in greatest dimension but has not invaded the main bronchus.



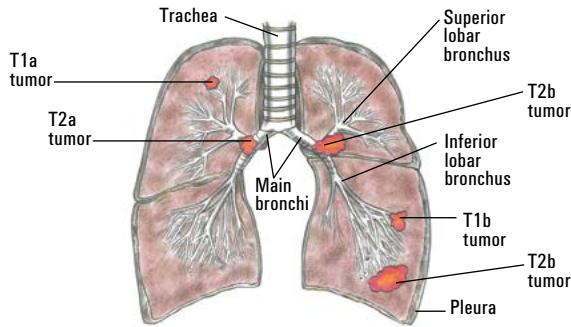
Stage IB

Tumor is larger than 3 centimeters but smaller than 5 cm in greatest dimension; or the tumor has spread to the main bronchus, invaded the visceral pleura (membrane surrounding the lungs), or is associated with atelectasis (collapse of part of the lung) or with obstructive pneumonitis (inflammation of lung tissue).



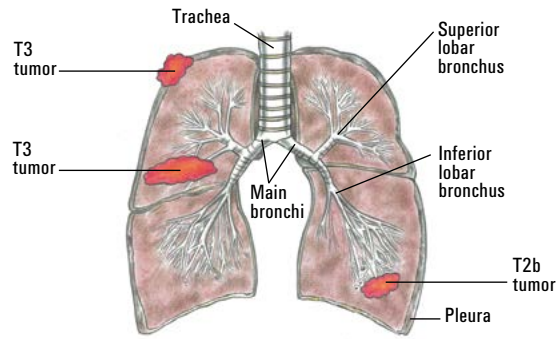
Stage IIA

Tumor is up to 7 cm in greatest dimension; or the tumor has spread to the main bronchus, invaded the visceral pleura (membrane surrounding the lungs), or is associated with atelectasis (collapse of part of the lung) or with obstructive pneumonitis (inflammation of lung tissue); spread to regional lymph nodes is likely.



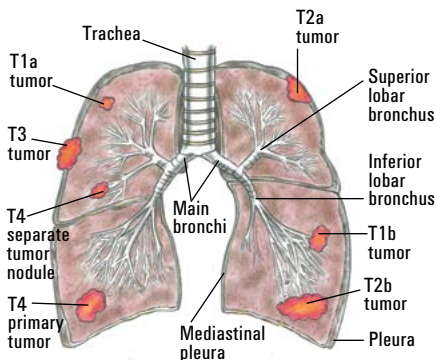
Stage IIB

Tumor has spread to any of the following: the main bronchus, visceral pleura (membrane surrounding the lungs), chest wall, diaphragm, phrenic nerve, mediastinal pleura or parietal pericardium; or tumor is associated with atelectasis (collapse of part of the lung) or with obstructive pneumonitis (inflammation of lung tissue); spread to regional lymph nodes is possible.



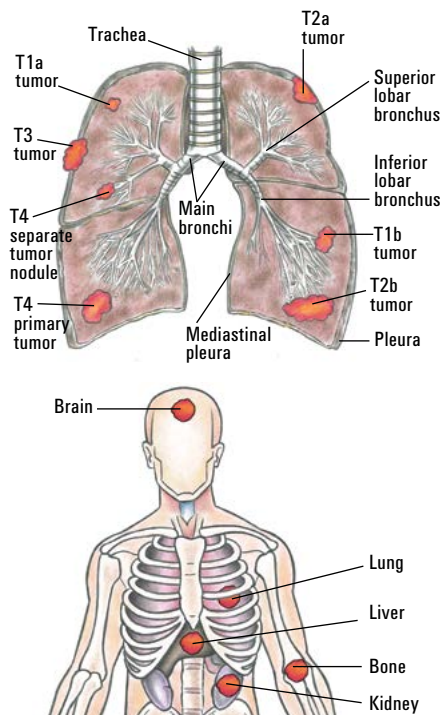
Stage IIIA

Tumor is any size and may have invaded surrounding structures, including the main bronchus, visceral pleura (membrane surrounding the lungs), chest wall, diaphragm, phrenic nerve, mediastinal pleura, parietal pericardium, heart, trachea, esophagus, vertebrae, carina or recurrent laryngeal nerve; spread to regional lymph nodes is likely.



Stage IV

Tumor is any size and has spread to the opposite lung and/or to distant organs in the body.



▼ **TABLE 2 | STAGES OF LUNG CANCER**

Stage	TNM classifications
0	Tis, N0, M0
IA	T1a or T1b, N0, M0
IB	T2a, N0, M0
IIA	T1a or T1b, N1, M0 T2a, N1, M0 T2b, N0, M0
IIB	T2b, N1, M0 T3, N0, M0
IIIA	T1a or T1b, N2, M0 T2a or T2b, N2, M0 T3, N1 or N2, M0 T4, N0 or N1, M0
IIIB	T4, N2, M0 Any T, N3, M0
IV	Any T, any N, M1a or M1b

→ Learn more about lung cancer staging at PatientResource.com



Your pathology report is an important document that provides information about the characteristics of your lung cancer. The pathology report serves as a guide for your oncologist and other members of your team to plan the treatment most likely to be effective for your particular lung cancer.

Pathology reports may look different at different cancer centers and hospitals, but most include the same information. The details and unfamiliar terms may seem overwhelming at first, but once you learn what the words mean, you'll be more informed about your diagnosis and better able to discuss your treatment options with your doctor.

Your diagnosis of lung cancer is based on the careful examination of tissue taken during the biopsy of a suspected tumor or of the entire tumor after definitive surgery (removal of the tumor with or without lymph nodes). A pathology report is prepared by a pathologist after he or she has examined the specimen with and without a microscope, recording its size, describing its location and appearance, and performing special testing (Table 1). Testing the tumor sample for genetic abnormalities, known as molecular testing, is now recommended, and the results of this testing have become more common on pathology

TABLE 1 | IMPORTANT COMPONENTS OF A LUNG CANCER PATHOLOGY REPORT

Descriptor	What is described or measured	What finding means
Size	Length and width of the tumor	Prognosis is likely to be better for smaller tumors; size is a primary factor in staging (see page 6).
Location	The lung (right or left) and lobe in which the tumor is found	
Histology	The histologic type: squamous cell carcinoma, adenocarcinoma, large cell carcinoma or small cell carcinoma (subtypes of each are also noted)	Treatments and prognosis vary according to histologic type.
Histologic grade	How much the tumor cells look like normal lung cells; reported as well-differentiated (G1; cells look mostly similar to normal cells), moderately differentiated (G2), poorly differentiated (G3; cells look very different from normal cells) or undifferentiated (G4)	The more the cancer cells look like normal cells (lower grade), the better the prognosis; the higher the grade, the more aggressive the tumor.
Surgical margins	Presence or absence of cancer cells in the normal tissue at the edges of the tumor	Additional surgery or radiation therapy may be needed if the margins are close or positive.
Extent of invasion	The structures affected by the tumor	Extent of invasion is a factor in staging and a consideration when selecting treatment, including determining whether a tumor is operable (can be removed safely with an operation).
Lymph node status	Presence (positive) or absence (negative) of cancer cells in the nearby lymph nodes	Negative lymph node status generally means a less extensive cancer and a better prognosis; lymph node status is another primary factor in staging (see page 6).
Molecular testing*	Presence or absence of genetic abnormalities: EGFR mutation, KRAS mutation or ALK gene rearrangement	Tumors with the EGFR mutation are more likely to respond to targeted therapy with an EGFR inhibitor, whereas tumors with the KRAS mutation are more likely to be resistant to an EGFR inhibitor; tumors with an ALK gene rearrangement are likely to respond to an ALK inhibitor.

*Molecular testing is now done more frequently before initial chemotherapy is given. Talk to your doctor about whether this testing should be done.

QUESTIONS YOU MAY WANT TO ASK YOUR DOCTOR

- ▶ **May I have a copy of my pathology report?**
- ▶ **What is the exact type of cancer I have?**
- ▶ **What is the stage of cancer and what does that mean in my case?**
- ▶ **Has the cancer spread to my lymph nodes or other organs?**
- ▶ **Would testing for genetic abnormalities be helpful?**
- ▶ **What is my prognosis?**

reports. The results of molecular testing are important because they can help guide treatment decisions.

The pathologist's final diagnosis is based on all the findings of the examination. Diagnosing lung cancer and identifying all of the characteristics of the tumor are challenging tasks and require the expertise of physician specialists. If the pathologist cannot determine the histologic type for any reason – for example, if the tumor sample is too small or the cancer is poorly differentiated (the cells look very different from normal cells) – an expert pathologist and special studies may be required or another biopsy may be needed. The accu-

racy of testing and interpretation of results is essential, and seeking a second opinion from another pathologist with extensive expertise in interpreting lung cancers can be beneficial, especially if there was difficulty or controversy in interpreting the findings. Be sure to seek the opinion of another pathologist if the pathology report does not contain a definite diagnosis, if you have a rare type of cancer or if the cancer has already spread. Another interpretation can confirm your diagnosis or may suggest an alternative diagnosis.

The pathology report also includes the stage of your lung cancer. Learn more about how lung cancer is staged on page 6. ■



variety of treatment options is available for lung cancer, including surgery, radiation therapy, chemotherapy and targeted therapy. These four

types are most often used in some combination, an approach called combined-modality or multimodality therapy. Each type of treatment is associated with side effects, but advances have made it possible to control these effects to help keep you comfortable. Treatment given with a goal of curing lung cancer is known as treatment with “curative intent,” and treatment given primarily to relieve symptoms is known as “palliative treatment.”

Your doctors will create a specific treatment plan according to several factors, such as your type of lung cancer, the stage of disease, the location of the tumor, the results of testing for genetic abnormalities in the tumor, and your overall lung function and general health.

▼ **TABLE 1 | TYPES OF SURGERY FOR LUNG CANCER**

Type of surgery	Description
Wedge/segmental resection	Removal of the tumor and some of the normal tissue around it (if a slightly larger amount of normal tissue is taken, it's called a segmental resection)
Lobectomy	Removal of a whole lobe (section) of a lung
Pneumonectomy	Removal of one whole lung
Sleeve resection	Removal of part of the bronchus (the main airway) or part of the pulmonary artery (artery to the lung), along with a lobe in order to save other portions of the lung

Surgery

Surgery is typically the treatment of choice when lung cancer is diagnosed at a very early stage. About one in every three or four non-small cell lung cancers is diagnosed at an early stage, but fewer small cell lung cancers are diagnosed early. Some tumors are considered to be inoperable because they are located near vital structures, and some people are not surgical candidates because of poor general health or decreased lung and/or heart

function. Ideally, the decision about whether a lung cancer tumor can be surgically removed should be made by a board-certified thoracic surgeon experienced in lung cancer surgery. When surgery is appropriate, surgical removal of the tumor is preferred over any other means of destroying the tumor, such as radiofrequency ablation, cryotherapy or stereotactic radiation.

Four types of operations are typically performed, and the type depends on how much of the lung is affected by cancer (Table 1). Surgeons may make a large cut in the chest to remove the tumor, called a standard thoracotomy, but the tumor may also be removed in an operation in which the surgeon makes a small incision, which preserves muscles and/or nerves in the area.

A newer technique, called video-assisted thorascopic surgery (VATS), involves the use of several small incisions through which the surgeon inserts small instruments to remove the lobe (or segment) of the lung. During VATS, the surgeon does not need to spread the ribs as in the other surgical approaches. VATS offers the advantages of less recovery time, shorter hospital stays and fewer complications, but VATS cannot be done when the tumor is large or is in a central location.

Robotic surgery is also being performed for lung cancer at some medical centers. With this type of surgery, the surgeon uses several small incisions and special instruments that bend and rotate much more than the human wrist; the surgeon also uses special equipment that allows a three-dimensional view inside the body. This operation requires special expertise by the surgeon, so ask your doctor how many of these procedures he or she has done.

During any of these operations, the surgeon will also remove lymph nodes or take tissue samples from the lymph nodes to see

GLOSSARY OF TERMS

- ▶ **Adjuvant therapy:** Treatment given after the primary therapy to help prevent recurrence (usually chemotherapy after surgery).
- ▶ **Chemoradiation therapy:** The use of both chemotherapy and radiation therapy. Chemoradiation therapy is described as either concurrent (when both treatment modalities are given during the same time period) or as sequential (when one modality is given after the other).
- ▶ **Combined-modality treatment:** The use of more than one type of treatment in the overall treatment plan (i.e., surgery, radiation therapy and/or chemotherapy); also known as multimodality treatment.
- ▶ **Curative intent:** Treatment given with the goal of curing the disease.
- ▶ **Doublet:** A chemotherapy regimen consisting of two drugs.
- ▶ **First-line therapy:** The initial treatment given; if the cancer does not respond, a different treatment regimen or second-line therapy can be tried. Third-line therapy may be given if second-line therapy fails.
- ▶ **Inoperable:** Unable to treat with surgery, either because of the stage or location of the disease or a person's health status; also known as unresectable.
- ▶ **Local therapy:** Treatment directed at the site of the tumor; surgery and radiation therapy are local therapies.
- ▶ **Maintenance therapy:** Treatment given after the end of standard chemotherapy to help prevent disease from progressing.
- ▶ **Margin (surgical):** The edge of the specimen removed during surgery. If the pathologist finds cancer cells in the margin (known as a positive margin), additional treatment may be needed.
- ▶ **Neoadjuvant therapy:** Treatment given before the primary therapy to help shrink the tumor (usually chemotherapy before surgery).
- ▶ **Primary therapy:** The initial treatment given with the intention to cure or prolong life.
- ▶ **Resection:** Surgical removal.
- ▶ **Surgical candidate:** A person healthy enough to have surgery. If a person has poor lung and/or heart function or other medical conditions, he or she may not be a candidate for lung cancer surgery, and other treatment options must be used.
- ▶ **Systemic therapy:** Treatment with chemotherapy or targeted therapy; the drugs travel throughout the body via the bloodstream.

if cancer has spread to them. You will receive general anesthesia for these operations so that you are asleep and not able to feel pain during the surgery.

Radiation therapy

Radiation therapy is the use of high-energy X-rays to kill cancer cells or keep them from growing. Newer radiation techniques are more effective than previous ones and are being considered as an initial therapy for small tumors in people who are not physically able to undergo surgery. The various types include:

■ **External-beam radiation therapy (EBRT)** –

The type of radiation used most often, EBRT is delivered from a machine outside of the body.

■ **Stereotactic ablative radiotherapy (SABR)** –

This is an advanced method of delivering radiation and uses 3-D computer imaging to deliver high doses of radiation through many small radiation beams highly focused on precise areas. This technique is used more frequently for small tumors in people with poor health.

■ **Intensity-modulated radiation therapy (IMRT)** –

This type of radiation is delivered to the chest area in various strengths and targets the tumor more exactly.

Radiation may be used as the primary treatment for early-stage lung cancer that is inoperable; as treatment after surgery (adjuvant therapy) or before surgery (neoadjuvant therapy), with or without chemotherapy; or as palliative therapy, to relieve symptoms associated with incurable lung cancer. Radiation may also be used to treat lung cancer that has spread to the brain.

A radiation oncologist will oversee your radiation therapy, and he or she will carefully plan your radiation therapy to calculate the appropriate dose and determine the optimum treatment schedule. Treatment schedules vary according to the type and stage of lung cancer and the method of delivering radiation. Standard EBRT is delivered in daily doses, five days a week, and may be given for six to seven weeks if treatment is with curative intent. With SABR, however, higher doses of radiation are given in just a few days. Each treatment session typically lasts 30 minutes or less and is painless, and radiation therapy for lung cancer will not make you radioactive.

Palliative radiation therapy that is directed at areas related to symptoms (such as the bones) can be delivered with usually only one to 10 treatments.

Chemotherapy

Traditional chemotherapy is the use of strong drugs to stop the growth of cancer, either by killing cancer cells or by preventing them from dividing and growing. Chemotherapy is sometimes referred to as conventional chemotherapy to distinguish it from targeted therapy, which also involves the use of drugs that travel throughout the body.

Chemotherapy is the primary treatment for all stages of small cell lung cancer unless a person's body cannot tolerate the drugs because of other medical conditions. Chemotherapy is also an option for all stages of non-small cell lung cancer except for Stage I. When used to treat non-small cell lung cancer, chemotherapy may be given after local therapy, such as surgery, to help prevent the

cancer from recurring (growing back). This form of treatment is known as adjuvant chemotherapy. Chemotherapy may also be given to help shrink the tumor to make it easier to remove surgically or to treat with radiation. This treatment is known as neoadjuvant (or preoperative) chemotherapy.

Chemotherapy may also be given during the same time period as radiation, which is referred to as concurrent chemoradiation therapy. It also may be used for non-small cell lung cancer as maintenance therapy, which is treatment given after the end of standard chemotherapy to help delay the progression of cancer.

Many drugs are available (Table 2), and the choice primarily depends on the type of cancer. For example, some drugs may be less effective for squamous cell carcinoma than for the other subtypes of non-small cell lung cancer. The choice also depends on how it's being used (e.g., for adjuvant treatment, for advanced disease, with radiation therapy, etc.) and how the benefits compare with the risks.

For first-line (initial) chemotherapy, the preference is to use a two-drug regimen, referred to as a doublet, with one of the drugs being a platinum drug (cisplatin or carboplatin). If the cancer does not respond to this treatment, or if the cancer progresses, a different drug may be tried. Second-line or third-line therapy is usually a single chemotherapy drug.

Chemotherapy is usually given intravenously (IV) through a vein in your arm, but some drugs may be taken by mouth. You may be able to receive IV chemotherapy in your doctor's office or in an outpatient clinic, and it typically takes 30 minutes to three hours for the chemotherapy to be completely infused. Chemotherapy is given in cycles, which refers to treatment on specific days over a period of time (usually 21 or 28 days). Sometimes different chemotherapy schedules can be used, and you can discuss the choice of schedule with your treatment team. Treatment plans may vary but usually consist of four to six cycles, and each cycle is followed by a rest period to allow your body to recover from the effects of the drug. Additional drugs to prevent side effects as well as additional fluids are often given intravenously. Your treatment team will discuss each of these with you.

▼ TABLE 2 CHEMOTHERAPY DRUGS USED FOR LUNG CANCER

Generic name	Brand name
carboplatin	n/a
cisplatin	n/a
docetaxel*	Taxotere
etoposide†	VePesid, VP-16, Etopophos
gemcitabine*	Gemzar
ifosfamide	Ifex
irinotecan†	Camptosar
mitomycin	Mutamycin
paclitaxel*	Taxol
paclitaxel, albumin-bound*	Abraxane
pemetrexed*	Alimta
topotecan†	Hycamtin
vinblastine	Velban
vinorelbine*	Navelbine

*Approved for use in combination with either cisplatin or carboplatin for non-small cell lung cancer. Pemetrexed is approved only for non-small cell lung cancers (except squamous cell carcinoma).

†Used most often alone or with a platinum drug for small cell lung cancer.

To see if the treatment is working – and to make a decision about when to stop or change treatment if it's no longer effective – physical exams and imaging studies are repeated after two and four cycles. When the tumor stops shrinking, the chemotherapy is temporarily stopped. Maintenance therapy with one or two drugs can then be considered.

Targeted therapy

Researchers have learned about the cell pathways involved in the development of many types of cancers and have developed drugs that block those pathways. These drugs are known as targeted drugs, and treatment is known as targeted therapy (Table 3). These drugs block the signals that proteins and other molecules send along signaling pathways, which are systems in the body that direct basic cell functions such as growth, division and death.

Effective targeted therapy depends on two factors: identifying targets that play an important role in the growth and survival of cancer cells, and developing agents that can attack those targets. The use of testing for genetic abnormalities in tumor tissue is helping to advance the use of this treatment. Targeted therapy, in combination with chemotherapy, is currently approved for advanced non-small cell lung cancers. As the results of ongoing research are reported, the hope is that the use of targeted therapy can expand to earlier-stage disease, which may extend survival for more people. Targeted therapy has not yet been found to be beneficial for the treatment of small cell lung cancer.

One signaling pathway involved in the development of many different kinds of cancer, including non-small cell lung cancer, is directed by the epidermal growth factor receptor (EGFR) protein, which is made by the EGFR gene. Abnormalities (mutations) in this gene activate the EGFR protein, which in turn triggers a complex process that leads to increased growth and division of cancer cells and allows the tumor to spread. Targeted therapy drugs have been developed to block the activity of EGFR, and these drugs are known as “EGFR inhibitors.”

Four EGFR inhibitors have been shown to be effective in clinical trials. It's important to test the tumor tissue for genetic abnormalities because response to an EGFR inhibitor is more likely if the tumor tests positively for the EGFR

TABLE 3 TARGETED THERAPY AGENTS USED FOR NON-SMALL CELL LUNG CANCER

Generic (brand) name	How given	Action of the drug	FDA-approved indication
afatinib (Gilotrif)	Orally (tablet)	Inhibits epidermal growth factor receptor (EGFR)	First-line treatment for metastatic non-small cell lung cancers that test positively for the EGFR mutation
bevacizumab (Avastin)	Intravenously	Inhibits vascular endothelial growth factor (VEGF), which prevents the formation of blood vessels in the tumor	First-line therapy, in combination with carboplatin and paclitaxel, for unresectable locally advanced, recurrent or metastatic non-small cell lung cancer other than squamous cell carcinoma
ceritinib (Zykadia)	Orally	Inhibits ALK, a protein produced by a mutated ALK gene	Metastatic non-small cell lung cancer, after failure of crizotinib (or intolerance to crizotinib)
cetuximab (Erbiximab)	Intravenously	Inhibits EGFR	Approved for use in other types of cancer
crizotinib (Xalkori)	Orally (capsule)	Inhibits ALK, a protein produced by a mutated ALK gene	First-line treatment for locally advanced and metastatic ALK-positive non-small cell lung cancer
erlotinib (Tarceva)	Orally (tablet)	Inhibits EGFR	Locally advanced or metastatic non-squamous cell cancer after failure of at least one other prior chemotherapy regimen Maintenance therapy for locally advanced or metastatic non-small cell lung cancer that has not progressed after four cycles of a first-line platinum-based chemotherapy regimen
gefitinib (Iressa)	Orally (tablet)	Inhibits EGFR	Limited by the FDA to patients currently receiving and benefiting from gefitinib and patients who have previously received and benefited from the drug

mutation and is less likely if the tumor tests positively for other mutations. This testing should be done before treatment is started because these targeted therapy drugs are superior to chemotherapy if the tumor has the EGFR mutation. Two EGFR inhibitors – erlotinib (Tarceva) and afatinib (Gilotrif) – are FDA-approved for the treatment of lung cancer that tests positively for an EGFR mutation.

Testing is now recommended for another genetic abnormality in which the ALK gene is rearranged. This abnormal gene produces a protein that causes cancer cells to grow out of control; stopping this abnormal protein can slow the growth of cancer cells. Targeted therapy drugs are now available to treat people who test positively for the ALK rearrangement; one drug, crizotinib (Xalkori), is approved for the treatment of lung cancer with the ALK rearrangement, and ceritinib (Zykadia) is approved to treat lung cancer that has not responded to crizotinib.

Another targeted agent used for non-small

cell lung cancer targets a different pathway, known as the vascular endothelial growth factor (VEGF) pathway, which is involved in the formation of new blood vessels. The targeted agent interferes with signals between VEGF and its receptors, and as a result, no new blood vessels are formed. Without vessels to bring blood to the tumor, it cannot continue to grow. One VEGF inhibitor, also known as an antiangiogenic drug, is approved for use in advanced non-small cell lung cancer. Unfortunately, no test exists to determine which people are most likely to benefit from a VEGF inhibitor, and this targeted therapy drug cannot be used for everyone.

One of the most important problems associated with both chemotherapy and targeted therapy is that cancer cells often become resistant to the drugs, which become less effective over time. Researchers continue to explore ways to overcome resistance, identify new pathways to target, and develop new drugs to interrupt the growth of lung cancer cells. ■

Choosing the best treatment plan for lung cancer can be challenging and requires the expertise of a multidisciplinary care team, which works together to determine the best treatment plan for your particular tumor. Even once a plan has been made, it may change, depending on the results of staging procedures and other test results.

The options listed here by stage provide basic information about how your cancer may be treated. Many other details are involved in making treatment decisions, and your doctors will discuss these details with you.

Non-small cell lung cancer

Stage 0 (*carcinoma in situ*)

Stage 0 cancer is usually treated with surgery (removal of the tumor with a wedge or segmental resection). Additional treatment is not generally needed but careful follow-up is important.

Stage I

Surgery – often a sublobar resection – is usually the primary treatment for Stage IA or IB disease. Lymph nodes in the mediastinum (area between the lungs) must be removed – or a sample must be taken from a node – during the surgery to see if cancer cells have spread to lymph nodes. Lymph node metastases will determine your prognosis and whether additional treatment is given after surgery. In most cases, no further therapy is given after surgery, but if the risk for recurrence is high (if the tumor is large, usually 4 centimeters [about 1½ inches] or more), chemotherapy after surgery may be offered. It's difficult, however, to determine who is at highest risk for recurrence, so talk to your doctor about the risks and benefits.

If the pathologist found cancer cells in the surgical margin of the normal tissue removed with the tumor, a second surgery to remove additional tissue may be needed. Chemotherapy and/or radiation therapy are other options for destroying cancer cells that may remain.

Radiation therapy can be used to treat disease in people who are not surgical candidates, and stereotactic ablation radiotherapy (SABR) is available at many treatment centers for people with small tumors that are not close to vital organs. Standard radiation may be given if SABR is not possible.

Stage II

Treatment for Stage II cancer depends on the location of the tumor. In general, surgery is the primary treatment. People who are not surgical candidates are often offered radiation therapy with or without chemotherapy. Chemotherapy after surgery is usually recommended for Stage II disease because it improves overall survival. On rare occasions, chemoradiation therapy or chemotherapy may be given before surgery to shrink a larger tumor so that it's easier to remove.

Stage IIIA

Making treatment decisions for Stage IIIA is complex and depends on many factors, including the location of the tumor, what tissues or structures it invades, whether cancer has spread to lymph nodes and, if so, the number and size of the involved lymph nodes. If cancer was not suspected in the lymph nodes but the pathologist detects cancer cells in these nodes after a potentially curative operation, additional treatment after surgery is recommended. This usually involves some combination of chemotherapy, radiation and surgery, or all three.

Chemoradiation therapy is often the first treatment option. If a limited number of lymph nodes with cancer cells are found on the same side as the tumor (staged as N2) – or if the tumor is bulky – then chemotherapy, with or without radiation, can be considered as the first treatment given before surgery. If the response to treatment is good – that is, the tumor shrinks and the involved lymph nodes are free of cancer – surgery (removal of part or the entire lung) may be done if the surgeon believes the remaining cancer can be removed entirely. Additional chemotherapy, alone or with radiation, may then be given after surgery.

Chemotherapy after surgery has been shown to improve survival for people in whom the cancer was considered to be Stage I or II before cancer was found in lymph nodes removed during surgery. If cancer cells are found in the surgical margins or in the removed lymph nodes, concurrent chemoradiation therapy may be given.

If surgery isn't an option, additional chemotherapy and/or radiation may help to further shrink the tumor and reduce the risk of the cancer coming back. If your doctors don't

suspect that your cancer is Stage III at the time of your surgery but find positive lymph nodes during surgery, you may be given chemotherapy or chemoradiation therapy after your surgery.

Stage IIIB

Surgery is not usually an option for Stage IIIB because the disease has spread too far. Therefore, treatment usually consists of concurrent chemoradiation therapy. In some centers, additional chemotherapy is given after radiation has been completed.

Stage IV

Stage IV (advanced) non-small cell lung cancer has been typically treated with chemotherapy, which cannot cure the cancer but can lengthen survival and improve quality of life. Studies have shown that if the disease is stable (not growing) after first-line chemotherapy, immediate second-line treatment with a different chemotherapy drug (known as “switch maintenance”) can improve the outcome. Surgery and radiation therapy are used in some instances to relieve symptoms and improve quality of life or to prevent further complications.

Targeted therapy now offers an additional option for many people with advanced cancer. In order for it to be used, however, genetic testing must be done on the tumor sample, and the treatment depends on the results:

- If the tumor tests positively for the EGFR mutation, options for targeted therapy include afatinib (Gilotrif), erlotinib (Tarceva) and gefitinib (Iressa).
- If the tumor tests positively for ALK rearrangement, treatment with crizotinib (Xalkori) is recommended; ceritinib (Zykadia) can be used if the disease fails to respond to crizotinib.
- If the tumor tests negatively for the EGFR mutation and ALK rearrangement, a platinum-based chemotherapy combination is recommended for people healthy enough to tolerate the drugs. People who are not healthy enough may receive a single drug or palliative therapy with radiation therapy, surgery or other supportive measures. If the cancer is a type other than squamous cell carcinoma, bevacizumab (Avastin) added to the platinum-based chemotherapy is an option.

If you have Stage IV lung cancer, talk to your doctor about supportive care. Studies have shown that supportive care not only enhances your quality of life but also extends survival.

Small cell lung cancer

Stage I-III B

Surgery followed by chemotherapy is often given with curative intent for Stage I or IIA disease (although small cell lung cancer is rarely detected at this early stage). Concurrent chemoradiation is typically given with curative intent to people who have Stage I or IIA disease but are not surgical candidates, or to people who have Stage IIB, IIIA or IIIB disease. If the cancer responds to treatment, radiation to the brain is given to prevent the return of lung cancer in the brain and to prolong survival.

Stage IV

Chemotherapy is the primary treatment for Stage IV disease or for earlier-stage disease that recurs after initial therapy. If the tumor responds to therapy, radiation therapy to the brain is given to prevent the return of cancer in the brain and to prolong survival. Radiation to the brain may also be given after chemotherapy if there is a good response to chemotherapy. Other types of radiation and surgical therapies may be used as palliative treatment to relieve symptoms and to improve quality of life.

Recurrent disease after surgery

In some instances, early-stage cancer recurs (comes back). The recurrence may be at a local site in the chest or at a site distant from where the primary tumor was found. If cancer recurs in or around the lungs and it's considered resectable, surgery may be done, followed by radiation therapy with or without chemotherapy. If the recurrence includes lymph nodes in the chest, concurrent chemoradiation therapy is an option. If the recurrence is outside the original lung cavity, the treatment choices are the same as the options for cancer that is Stage IV at the time of diagnosis.

Metastatic disease

Two of the most common sites of metastasis from lung cancer are the brain and bone.



■ **Brain metastasis** – Chemotherapy may not be effective for cancer that has spread to the brain because of the blood-brain barrier, which is a membrane (thin lining of tissue) that protects the brain by preventing substances in the blood, such as drugs, from entering the brain. Therefore, local therapies are often used, and the choice of treatment depends on the number and location of the metastatic tumors. If there is a single metastatic site in the brain, surgery followed by whole-brain radiation therapy may be done. Another option is stereotactic radiosurgery (also known as Gamma Knife or CyberKnife). This approach is primarily used only when no more than three small metastatic tumors are present. Because the radiation is delivered precisely to the metastatic site, side effects are less likely to occur with stereotactic radiosurgery than with whole-brain radiation therapy.

Whole-brain radiation therapy is usually the treatment of choice for people with more than three metastatic brain tumors. Corticosteroids are usually given with the radiation to limit swelling in the brain, and the drugs may be discontinued after the treatment effects are over. If a person has had any type of seizure, medications are given to prevent future seizures. If the metastases are small and cause no symptoms, chemotherapy or targeted therapy may be used because enough of the drug may cross the blood-brain barrier to be effective.

■ **Bone metastasis** – The spread of cancer to bone can cause the loss of bone mass. This condition occurs when the bone cells that

help rebuild bone don't get replaced at the same rate as bone cells that naturally break down bone. Bones become thin and full of tiny holes and are more likely to break or cause pain and disability.

Radiation therapy can be used to relieve pain and help prevent or treat fractures, especially if the involved bone is a weight-bearing one. Radiation beams are targeted to the area of the metastasis, and relief of symptoms is usually immediate and complete. If you've had a fracture or your doctor thinks you're at a high risk for one, orthopedic surgery may be recommended.

Two drugs are also available to help prevent this loss of bone mass: zoledronic acid (Zometa) and denosumab (Xgeva). Treatment with either of these drugs will help prevent bone fractures and can reduce the need for radiation to alleviate bone pain. These medications are usually given with each cycle of chemotherapy and are sometimes given to maintain bone health in people who no longer need chemotherapy. ■

ADDITIONAL RESOURCES

American Academy of Orthopaedic Surgeons:
www.aaos.org

Metastatic Bone Disease

American Cancer Society: www.cancer.org

Bone Metastasis Overview

Lung Cancer Alliance:
www.lungcanceralliance.org

Understanding Brain Metastases: A Guide for Patient and Caregiver

National Comprehensive Cancer Network:
www.nccn.com

NCCN Guidelines for Patients: Non-Small Cell Lung Cancer

Fears about the side effects of treatment can increase the stress of a lung cancer diagnosis. These fears grow from a belief that the discomfort of side effects cannot be relieved, but it's now possible to prevent or manage many common side effects of lung cancer treatment. Managing side effects is important because if you feel better, you're more likely to complete your treatment as planned, which offers a greater chance for a good outcome.

The side effects of cancer treatment differ in many ways. First, not all people treated for lung cancer will have the same side effects. Whether or not you experience a side effect depends on many factors, including your age, your overall health and your specific treatment plan. Second, side effects vary in severity. Some cause minor inconvenience, and others may cause more discomfort, pain and/or emotional distress. Lastly, side effects differ according to the type of treatment you receive (Table 1).

Among the most common or troublesome side effects of lung cancer treatment are shortness of breath (dyspnea), nausea and vomiting, fatigue, low white blood cell count (neutropenia), low red blood cell count (ane-

mia), hair loss (alopecia), dry mouth/mouth sores, skin rashes and diarrhea.

Many chemotherapy drugs can cause nausea and vomiting, and your doctor will likely prescribe drugs known as antiemetics before you begin treatment to help prevent these side effects. Eating small meals throughout the day (rather than three large meals) and drinking plenty of fluids can also help ease any nausea you might experience. High-protein and high-calorie supplements may also help.

A low white blood cell count can increase your risk of infection and can be caused by both chemotherapy and radiation. Your doctor will closely monitor your complete blood count (CBC) and prescribe treatment with growth factors – special proteins that can stimulate the production of more white blood cells – if necessary. Fever is also a common sign of infection, so call your health care provider immediately if you have a fever.

You might also experience a side effect called peripheral neuropathy, which includes feelings of numbness, tingling or weakness in your hands and feet. This is usually a side effect of chemotherapy, and your doctor might refer you to a physical or occupational therapist to help with strengthening exercises. Avoid snug shoes, tight socks and extreme temperatures,

and take part in regular exercise, such as walking, to help with this side effect.

Many other treatment side effects are possible, including a low platelet count (which can cause easy bruising/bleeding), a loss of appetite (anorexia) and dehydration. Talk to your doctor about how likely these side effects are with your particular treatment.

Some drugs used to treat lung cancer may interact with other drugs or supplements. These interactions can cause the level of the drugs in your bloodstream to increase or decrease; higher levels may cause more side effects and lower levels may be ineffective against the cancer. Be sure to tell your doctor or another member of your team about all the drugs you take, including over-the-counter medications, and herbal and drug supplements.

It's impossible to predict how each person will be affected by lung cancer treatment, but talking with your treatment team can better prepare you for what may happen. Knowing what to expect and how to help prevent or manage side effects can help you feel in control of your body, improve your quality of life, and ensure you have the best chance for treatment to be effective. ■

ADDITIONAL RESOURCES

American Cancer Society: www.cancer.org

Anemia in People with Cancer

Fatigue in People with Cancer

Nausea and Vomiting

Seven Ways to Manage Cancer-Related Fatigue

American Society of Clinical Oncology

(**patient website**): www.cancer.net

Coping with Cancer-Related Fatigue

Hair Loss or Alopecia

The Importance of Hydration

Skin Reactions to Targeted Therapy

CancerCare: www.cancercare.org

Dry Mouth

CancerSymptoms.org:

www.cancersymptoms.org

About Cancer Fatigue

Cancer and Chemotherapy-Induced Anemia

Lung Cancer Online Foundation:

www.lungcanceronline.org

Symptoms, Side Effects & Complications

National Cancer Institute: www.cancer.gov

Coping with Cancer: Managing Physical Effects

Managing Chemotherapy Side Effects: Alopecia (Hair Loss)

Managing Chemotherapy Side Effects: Anemia

Managing Radiation Therapy Side Effects: What to Do About Hair Loss

Nausea and Vomiting (PDQ)

▼ | **TABLE 1 | COMMON SIDE EFFECTS ACCORDING TO TYPE OF TREATMENT**

Type of treatment	Underlying cause of side effects	Possible side effects
Surgery	Damage to tissues; removal of lymph nodes	<ul style="list-style-type: none"> • Pain and weakness in the chest and arm • Dyspnea • Infection
Chemotherapy	Damage to normal cells, primarily the cells lining the digestive tract and mouth; hair follicles; and blood-forming cells in the bone marrow	<ul style="list-style-type: none"> • Nausea and vomiting • Hair loss (alopecia) • Fatigue • Decrease in the number of red blood cells, white blood cells and platelets, which can result in an increased risk for infections and bleeding • Neuropathy
Radiation therapy	Damage to normal cells, primarily the skin cells in the area being irradiated and the cells lining the digestive tract and mouth	<ul style="list-style-type: none"> • Dry, sore throat • Mouth sores • Difficulty swallowing • Skin sensitivity (redness, dryness, peeling, itchiness) • Fatigue
Targeted therapy	Blocked proteins on the surface of cancer cells but also on the surface of other (normal) cells	<ul style="list-style-type: none"> • Acne-like rash • Flu-like syndrome • Diarrhea/constipation • Loss of appetite • Fatigue • Dry, itchy skin • Slow-growing, brittle hair • Nausea and vomiting • Mouth sores

Husband and Wife Both Beat Lung Cancer

Paul and Barbara Bell have been happily married for 40 years, and with each other's support, they have both beaten lung cancer. Paul, now 72, is a retired General Motors supervisor who enjoys yard work, exercising, hanging out at home and meeting friends for coffee. Barbara, now 77, is a retired residential real estate salesperson who fills her time playing duplicate bridge, gardening, lunching with friends, discussing politics and exercising.

Cancer unfortunately affects a lot of families. Less commonly it affects both husband and wife. Even less commonly do both husband and wife share the same type of cancer. Falling into that last category are Paul and Barbara Bell, both forced to face lung cancer.

During a routine physical at age 53, Paul learned of a spot on his lung. A surgeon identified the spot as Stage IIIA adenocarcinoma, a type of non-small cell lung cancer, which had also spread beyond the lung into the lymph system and to the soft tissue of his chest.

Paul's first oncologist was pessimistic about a cure, so they sought a second opinion out of state. During that consultation, the oncologist told them about a promising clinical trial and said, "Mr. Bell, if you want to fight, we'll help you fight." Impressed with his attitude, Paul and Barbara put their lives on hold so Paul could receive the treatment in which they both believed.

"By being away from our everyday lives, we were able to make his successful treatment our main focus rather than viewing it as an interference," Barbara said. "We were both determined to devote that part of our lives to his survival."

Paul's clinical trial involved concurrent radiation therapy and chemotherapy: radiation five days a week for about six weeks and four cycles of both cisplatin and etoposide (Etopophos). He also took prescription anti-nausea medications, which worked well; he never vomited during treatment. While Paul did lose some weight, he and Barbara were determined to avoid a feeding tube.

"We had a consultation with an oncology-certified nutritionist who prescribed calorie, protein and liquid goals for each day, and my job was to meet those goals," Paul said. "Barbara said she would get or cook me anything at any time I felt I could eat."

Paul avoided the feeding tube, and the clinical trial was successful. Aside from pain in his chest at the surgical site and some nerve and muscle damage in his right shoulder, he made a full recovery.

"While Paul was in treatment, I knew he might die, but I never believed he would die," Barbara said.

Eighteen years after the conclusion of Paul's treatment, Barbara was forced to turn that attitude inward. She'd been having persistent respiratory problems for about three months, so her



doctor ordered an X-ray, which showed a spot on her right lung. A CT scan confirmed the lesion, and a PET scan and biopsy revealed Stage I squamous cell carcinoma, also a type of non-small cell lung cancer.

Due to the success of Paul's treatment, the couple sent the scans to Paul's radiation oncologist and again traveled out of state for treatment. Considering Barbara's age, lung function and early-stage disease, the oncologist recommended four rounds of stereotactic radiation performed on four consecutive days rather than surgery. The Bells agreed, and the treatment effectively shrank and killed her tumor.

Barbara was told the radiation might cause a small sunburn-like spot on her back, but mild shortness of breath was her only side effect.

"Through the entire ordeal, Paul was my main support," Barbara said. "He kept telling me, 'Honey, we can do this.'"

And "do this" they did. Barbara continues to go in for check-ups every three months, and Paul had a false-positive test result a few years ago. It appears that the worst is behind them, and that's exactly where they intend to keep it.

"Cancer was a period in my life many years ago," Paul said. "I'll never forget it, but I don't dwell on it either."

Barbara shares the same attitude: "While I'm aware that a new tumor could show up, I don't obsess over it. I'll worry about it if it happens. When you get into the fight, remember that cancer is just a disease like any other: not a horror story, not a death sentence." ■

Dyspnea is a medical term that means difficulty breathing, and it's a common symptom among people with lung cancer. Nearly 90 percent of people with lung cancer have dyspnea at some point during their cancer journey.

Causes of dyspnea

Dyspnea can be related to the lung cancer itself, to certain cancer treatments or to conditions unrelated to cancer. Some of the most common causes of dyspnea in people with lung cancer include:

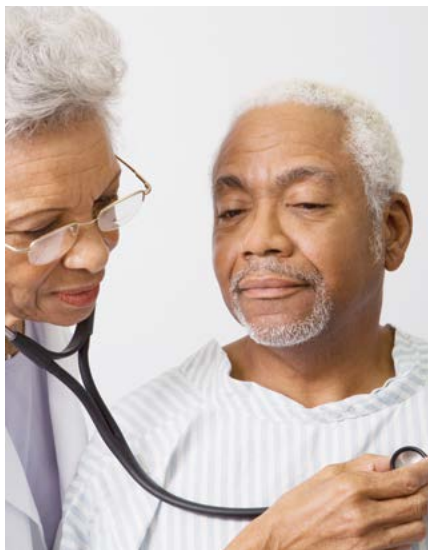
- **Airway obstruction:** The tumor is blocking the airways in the chest or lung(s).
- **Blood vessel obstruction:** Blood clots and/or tumor cells are blocking a blood vessel in the lung(s).
- **Pleural effusion:** The tumor is causing excess fluid to accumulate around the lungs.
- **Carcinomatous lymphangitis:** The tumor has spread through the lymphatic system of the lung(s).
- **Diaphragmatic paralysis:** The tumor has spread and blocked a nerve, causing paralysis of all or part of the diaphragm.
- **Chronic obstructive pulmonary disease (COPD):** This group of lung diseases often accompanies lung cancer and may block airflow.
- **Emphysema:** One of several diseases of COPD, emphysema damages the air sacs of the lungs.

Some of the most common causes of dyspnea related to lung cancer treatments include:

- **Radiation pneumonitis:** The lung has been damaged by radiation therapy.
- **Weakened heart muscle:** The heart has become weak from chemotherapy.
- **Chest infection:** An infection, such as pneumonia, has developed because cancer treatments have increased the risk for chest infections.

Symptoms of dyspnea

People with lung cancer often describe dyspnea as a feeling of breathlessness or being short of breath. They feel like they can't get enough air, and in extreme cases, they feel like they're being suffocated or smothered. This can sometimes lead to anxiety and panic,



which can worsen dyspnea and start a cycle that is difficult to stop. If left untreated, dyspnea can become serious and even life-threatening, so be sure to talk openly with your doctor about this condition.

Diagnosing dyspnea

If you have symptoms of dyspnea, your doctor will likely perform a physical examination and assess your lung function. In addition, one or more of the following tests may be done:

- **Chest X-ray:** A chest X-ray is a picture of the inside of your chest.
- **Computerized tomography (CT) scan:** A CT scan uses X-rays to create a three-dimensional picture of the inside of your chest.
- **Complete blood count:** This blood test measures a variety of things, including the number of red blood cells, white blood cells and platelets; the amount of hemoglobin in the red blood cells; and the percentage of blood made of red blood cells.
- **Oxygen saturation test:** This procedure tests how much oxygen the red blood cells are carrying.
- **Maximum inspiratory pressure (MIP) test:** This test measures your lung pressure.

Treating dyspnea

How dyspnea is treated depends mostly on the cause. If a tumor is causing the dyspnea, your doctor may recommend radiation therapy, chemotherapy, hormone therapy, laser therapy or cauterization (burning) to shrink or destroy the tumor. If a blocked air-

way is causing the dyspnea, your doctor may choose to place a stent in the airway to help hold it open. And if anemia is causing the dyspnea, your best course of treatment may be a blood transfusion.

Sometimes, dyspnea can be caused by excess fluid. In these cases, procedures to drain the fluid surrounding the lungs (pleural effusion), heart (pericardial effusion) or abdominal cavity (ascites) are likely the best treatment choice. Certain medications, including antibiotics, steroids, bronchodilators, anticoagulants and diuretics, may also help you effectively manage the symptoms of dyspnea. Talk to your doctor about which treatment options may be right for you.

Managing dyspnea

Aside from the medical treatments listed here, various techniques and exercises can help you breathe easier on a daily basis. These include:

- Receiving extra oxygen from a tank or other device
- Taking opioid medications to encourage relaxation and reduce anxiety
- Performing breathing techniques to help you take in more air
- Quitting smoking and/or avoiding smoky places
- Opening windows or turning on fans to increase air circulation
- Using a humidifier or vaporizer to moisten the air
- Drinking a lot of water to help thin mucus and make coughing easier
- Performing light exercises to increase the flow of oxygen to your blood
- Sleeping with your head propped up on pillows
- Practicing relaxation training or meditation to encourage relaxation and reduce anxiety

Each of these options may help you maximize the delivery of oxygen to your lungs. Just be sure to talk to your doctor before trying something new. ■

ADDITIONAL RESOURCES

American Society of Clinical Oncology (patient website): www.cancer.net

Shortness of Breath or Dyspnea

National Cancer Institute: www.cancer.gov
Cardiopulmonary Syndromes



About half of all people diagnosed with lung cancer are also smokers, and as many as 80 percent of them continue to smoke after their diagnosis. “Why quit?” most smokers ask, not realizing there are several good answers to that question.

One of the main reasons people continue smoking after a diagnosis is that they believe quitting is pointless. However, the truth is quite the opposite. People who continue to smoke after a diagnosis of early-stage lung cancer almost double their risk of dying. Smoking also increases the risk of a second cancer and other serious illnesses, such as heart disease.

Tobacco use also decreases the chance of a successful and effective treatment. Smoking can alter levels of chemotherapy in your body, which can have a negative effect on how well the drugs work. If you have surgery as part of your treatment, smoking can increase the risk of complications after your procedure, which may mean a slower recovery.

Another reason? Smoking also increases your risk of additional side effects during treatment, including dry mouth, loss of taste, problems with your bones, infection, fatigue, weight loss, and even more heart and lung problems.

While quitting may be difficult, the benefits far outweigh the costs. Some of these benefits are immediate, and you’ll notice an improvement right away. Perhaps you’ll

Smoking increases the risk of a second cancer and other serious illnesses, such as heart disease.

have an improved appetite, sleep or mood. You may have an increased activity level or enhanced emotional well-being and self-esteem. Everyday activities, such as climbing stairs or cleaning the house, may not leave you so out of breath. In addition to these improvements to your day-to-day life, the long-term benefits are invaluable. Not only will quitting increase the time it takes for cancer progression, but it also increases your chance of longer overall survival.

Unfortunately, nicotine, a natural drug found in tobacco, is addictive. When you stop smoking, you may experience withdrawal symptoms, and your mental dependence will compel you to go back to your old habits. But remember, you’re not alone. Your health care team will encourage and support you throughout this process. No matter where you are in your treatment, you will always have the opportunity to quit tobacco. Many people hesitate to tell their doctors out of fear that their doctor will

judge them or they will receive less support for their treatment. This is not true. Your health care team is well aware of the consequences of smoking, and they are dedicated to helping you reach this goal.

There are many other resources at your disposal that can assist you on this journey. Medications may help you with withdrawal, and counseling may help you cope with quitting. Reaching out to others may also be helpful; support groups can be found online or in person. Many former smokers say that a support network of family and friends was very important when they quit. Let your friends know what you’re doing and ask them for their help.

When you make the decision to quit, you should choose a “quit” day when you completely stop smoking. Find a day that’s not too far off but gives you enough time to prepare for it. Talk to your doctor about your plans and ask about your options, such as nicotine replacement. Begin by getting rid of all ashtrays and cigarettes, and stock up on oral substitutes such as sugarless gum, sunflower seeds or toothpicks. Make sure to tell your family and friends, and ask them to avoid smoking around you. When your quit day arrives, exercising and enjoyable activities may help distract you from those familiar urges. It’s important to adhere to your plan and stay strong to your commitment.

Quitting is not easy, and studies have shown that most people need more than one attempt before they successfully stop smoking. If you don’t succeed the first time, keep trying! ■

FIND HELP TO QUIT

As you make the decision to quit smoking, you’ll find many online resources dedicated to helping you take the first step:

- ▶ **American Cancer Society – Guide to Quitting Smoking:** www.cancer.org
- ▶ **American Legacy Foundation – Become an EX:** www.becomeanex.org
- ▶ **LiveHelp Online Chat:** <https://livehelp.cancer.gov>
- ▶ **My Time to Quit:** www.mytimetoquit.com
- ▶ **National Cancer Institute Smoking Quitline:** 877-44U-QUIT
- ▶ **Smokefree.gov:** <http://smokefree.gov>
- ▶ **Smokefree Women:** <http://women.smokefree.gov>

Pain is a leading fear for many people with lung cancer. But cancer doesn't have to mean pain. You're entitled to having a doctor totally committed to relieving the pain you may experience as a result of lung cancer and its treatments, and one who also makes sure that any side effects from attempts at pain control are acceptable to you. So, if you don't already have someone like that on your multidisciplinary health care team, ask for a referral. Improved pain control can lead to improved outcomes, so the more you and your doctor can keep your pain in check, the better your overall outlook.

Causes of cancer pain

For many people, pain can come from the lung cancer itself. As a tumor spreads, it can press on an internal organ, bone or joint, creating pressure that leads to pain. A tumor can also cause pain by damaging nearby tissues and nerves as it grows into them, and by producing chemicals that disrupt the balance of that area of the body.

While lung cancer treatments can be beneficial, they can sometimes cause pain as well. For example, if you have surgery to treat your cancer, you may experience pain as your

KEEPING TRACK OF CANCER PAIN

A pain diary is an easy way to track what pain you're experiencing and what pain-relief methods are working, and it will help your medical team modify your care to make you as comfortable as possible.

Use a consistent pain scale, like rating your pain from 0 to 10 (with 0 being no pain and 10 being the worst pain imaginable), and write down answers to questions such as:

- ▶ **What does the pain feel like?**
- ▶ **Is it mild or severe?**
- ▶ **Is it constant or does it come and go?**
- ▶ **Is it dull or sharp?**
- ▶ **When do you feel pain (morning, night, random times)?**
- ▶ **Are there specific triggers, like bending or stooping?**
- ▶ **How long does the pain usually last?**
- ▶ **What helps relieve your pain?**
- ▶ **Are you experiencing any side effects from your pain medications?**

body heals and recovers from the procedure. Chemotherapy and radiation therapy can also cause pain by damaging healthy cells, which can result in painful side effects such as burning sensations, mouth sores, diarrhea, nerve damage and more. You should not avoid these treatments because they may cause pain. Rather, you should keep an open dialogue with your doctor about any pain you experience so it can be controlled.

Types of cancer pain

Everyone experiences pain in different ways, but it's useful to distinguish among the main types:

- Acute pain usually comes from injury or damage to bodily tissues. It comes on as a direct result of a trauma – surgery, for example – so the cause can usually be readily diagnosed. Standard pain medication is often effective.
- Chronic pain, also called persistent pain, lasts long after the bodily injury heals and can be more resistant to medical treatments. It can be very taxing on both your body and your emotional state. However, using the various treatments available today, chronic pain can be effectively managed in the vast majority of people.
- Breakthrough pain includes severe flares of pain that “break through” regular pain medications. Sometimes these flares are related to an event, such as coughing, and sometimes they're sudden and unpredictable. These outbreaks can be mild to severe and can last for up to an hour a few times a day, but breakthrough pain can still be managed using various techniques.

Management of lung cancer pain

The options for managing cancer pain are numerous, and it can be helpful to think of them as tools in a toolbox. Sometimes just one tool can fix the problem, but other times the whole toolbox will be required. In addition, you'll sometimes need to use tools in a particular sequence, while other times you may need to jump back and forth between tools.

The following descriptions of various pain relief techniques are meant to provide you with a general overview of what's available. That way, if your doctor doesn't mention one or more of them as options for your care,

you'll be equipped to ask whether they might be right for you.

■ **Pharmacotherapy** is the treatment of cancer pain through the administration of medications, including non-opioid, opioid, adjuvant and topical analgesics:

- Non-opioid analgesics are often available over-the-counter and include aspirin, ibuprofen (Advil, Motrin), acetaminophen (Tylenol), etc.
- Opioid analgesics require a prescription and help decrease both the perception of pain and the reaction to pain. Codeine, oxycodone and morphine are all examples of opioid analgesics.
- Adjuvant analgesics, including certain antidepressants and anticonvulsants, aren't primarily designed to control pain, but they can sometimes be used for this purpose, especially in cases where damaged nerve cells result in neuropathic pain.
- Topical analgesics are either sprayed on or rubbed into the skin, directly over the painful area. They can include one or more medications and are often made-to-order by a compounding pharmacy. Topical analgesics may cause less severe side effects than other analgesics because they're not ingested.

■ **Percutaneous pain techniques** refer to procedures that access inner organs and tissues by puncturing the skin with a needle. They include ablative techniques, nerve blocks, kyphoplasty, vertebroplasty and sacroplasty:

- Ablative techniques include various procedures used to turn off nerves that signal pain, thereby providing pain relief.
- Nerve blocks usually involve injecting a pain-killing medication around certain nerves that send pain signals to your brain. Nerve blocks can be used on sympathetic, peripheral and cranial nerves.
- Kyphoplasty, vertebroplasty and sacroplasty are all procedures in which bone cement is injected into the spine or sacrum to stabilize the area and relieve pain.

■ **Neurosurgical approaches** to pain relief seek to lessen pain at its source: in the neural pathways and processing centers of the spine and brain. Recent medical innovations have

opened up many more neurosurgical pain relief options than were available in the past, including electrical stimulation, which can “jam” pain pathways and block pain, as well as intracranial and spinal ablation, which can turn off specific brain and spinal cord fibers that include pain-carrying nerves.

■ **Intrathecal drug delivery**, also called a “pain pump,” sends pain medication directly to your spinal cord using a small pump that’s surgically placed in the abdominal wall. Because the medication goes directly to your spinal cord rather than first traveling through your entire system, it’s effective in much lower doses than oral medications and without the usual side effects.

■ **Palliative oncology**, also called supportive oncology, can help mitigate cancer pain through surgery, radiation and chemotherapy. Palliative radiation and chemotherapy can shrink a tumor that is causing pain, or palliative surgery can be done to remove part or all of such a tumor, stabilize the spine and keep organs functioning, thereby reducing pain. Palliative radiation therapy may also relieve pain caused by bone metastases (the spread of cancer to bone).

■ **Physiatry**, or physical medicine and rehabilitation, helps relieve pain through customized therapy programs designed to enhance mobility, overcome disabilities and avoid painful activities when cancer or its treatments affect how you move and function. Anti-inflammatory injections are also a part of this technique.

■ **Alternative and complementary strategies** include yoga, acupuncture, reflexology, massage, aromatherapy, art therapy, music and animal therapy. While these strategies may not single-handedly solve cancer pain, they do have a role in pain management.

■ **Psycho-behavioral strategies** involve activities such as deep relaxation and meditation. They are useful in calming psychological symptoms such as anxiety and depression, which often accompany cancer pain and can get in the way of its treatment.

Keep in mind that there are risks and benefits associated with all types of pain relief techniques, so always review them with your health care team before beginning treatment.

Speak up about cancer pain

Lung cancer pain is often undertreated be-



CONFRONTING THE MYTHS OF PAIN MEDICATION

MYTH If I take narcotics regularly, I may become addicted.

FACT While people can become tolerant to a pain medication (meaning ever-increasing doses are required to achieve the same effect), it is not the same as addiction. People with cancer who take pain medication as directed by their doctors usually do not become addicted.

MYTH If I start taking pain medication early on, I will run out of options for pain relief in the future.

FACT Many pain-relieving medications and procedures are available. There will almost always be options if pain becomes more severe.

MYTH I don’t want to have unpleasant side effects from pain medications.

FACT Side effects do occur with some pain medications, but they can be managed and some will decrease or

disappear over time. Unacceptable side effects are a reason to ask your doctor about formulating an alternative plan for pain relief, such as different methods of delivery of pain medications or non-medication-based treatments.

MYTH Increasing pain means the disease is getting worse.

FACT Pain and severity of disease are not necessarily related, but increasing pain should prompt a conversation with your doctor to evaluate the cause and develop a plan for more acceptable pain relief.

MYTH I don’t want to bother the doctor. Having pain should be expected.

FACT Although pain is common, your doctor and other members of your treatment team should always be willing to help find ways to control your pain so you can enjoy a better quality of life.

cause many patients are reluctant to discuss it. Don’t fall into that category. Ask about pain management right from the start, and continually alert your doctor at the first sign of pain. A pain diary, as discussed in the box on page 18, can help you monitor your pain, know what to report and decide when to call your doctor. Pain relief works best when it’s done proactively rather than reactively, and ideally, pain should be addressed long before it becomes an emergency.

In addition, if you’re having unacceptable side effects from pain medications, such as extreme fatigue, constipation, etc., discuss those issues with your doctor as well. Efforts can be made to employ different strategies to both get you the necessary pain relief and avoid unacceptable side effects. The goal is a satisfactory quality of life. ■

ADDITIONAL RESOURCES

American Chronic Pain Association:
www.theacpa.org

Cancer Pain Research Consortium:
admin@cancerpainresearchconsortium.org
Center for the Relief of Pain (administrative center of the Consortium): 816-363-2500

Cancer Support Community:
www.cancersupportcommunity.org

Pain

National Cancer Institute:
www.cancer.gov

Coping with Cancer: Supportive and Palliative Care (Managing Physical Effects)

Pain Control: Support for People with Cancer

PainFromCancer.org:
www.painfromcancer.org

Patient Resource:
www.PatientResource.com

U.S. Pain Foundation:
<http://uspainfoundation.org>

ADVOCACY & ASSISTANCE RESOURCES

Cancer education

American Cancer Society	www.cancer.org
American Society of Clinical Oncology (patient website)	www.cancer.net
Association of Community Cancer Centers	www.accc-cancer.org
CANCER101	www.cancer101.org
CancerCare	www.cancercare.org
CancerQuest	www.cancerquest.org
The Center for Cancer Support & Education	www.centerforcancer.org
The Gathering Place, A Caring Community for Those Touched by Cancer	www.touchedbycancer.org
GetPalliativeCare.org	www.getpalliativecare.org
Global Resource for Advancing Cancer Education	www.cancergrace.org
The Hope Light Foundation	www.hopelightproject.com
National Cancer Institute	www.cancer.gov
National Comprehensive Cancer Network	www.nccn.org
OncoLink	www.oncolink.org
Pine Street Foundation	www.pinestreetfoundation.org
Wellness Place	www.wellnessplace.org

Caregivers & support

Bloch Cancer Hotline	800-433-0464
Cancer and Careers	www.cancerandcareers.org
CancerCare	www.cancercare.org
Cancer Connection	www.thecancerconnection.org
Cancer Hope Network	www.cancerhopenetwork.org
Cancer Really Sucks!	www.cancerrealsucks.org
Cancer Support Community	www.cancersupportcommunity.org
Cancer Survivors On Line	www.cancersurvivors.org
Cancer Wellness Center	www.cancerwellness.org
Caregiver Action Network	http://caregiveraction.org
CaringBridge	www.caringbridge.org
Cleaning for a Reason	www.cleaningforareason.org
Cuddle My Kids	www.cuddlemykids.org
Family Caregiver Alliance	www.caregiver.org
Fighting Chance	www.fightingchance.org
Guide Posts of Strength Inc.	www.cancergps.org
Imerman Angels	www.imermanangels.org
The LGBT Cancer Project – Out With Cancer	www.lgbtcancer.org
LivingWell Cancer Resource Center	www.livingwellcrc.org
Lotsa Helping Hands	www.lotsahelpinghands.com
MyLifeLine.org Cancer Foundation	www.mylifeline.org
The Patient Partner Project	www.thepatientpartnerproject.org
PearlPoint Cancer Support	www.pearlpoint.org
Strike Out Cancer	www.strikeoutcancer.com
Walk With Sally	www.walkwithsally.org
Well Spouse Association	www.wellspouse.org
weSPARK (Cancer Support Center)	www.wespark.org
Wonders & Worries	www.wondersandworries.org

Clinical trials

CenterWatch	www.centerwatch.com
Coalition of Cancer Cooperative Groups	www.cancertrialshelp.org
My Clinical Trial Locator	http://myclinicaltriallocator.com
National Cancer Institute	www.cancer.gov/clinicaltrials
Stand Up to Cancer	www.standup2cancer.org

Complementary programs & alternative medicine

The Annie Appleseed Project	www.annieappleseedproject.org
The Center for Mind-Body Medicine	www.cmbm.org
Exceptional Cancer Patients	www.ecap-online.org
Office of Cancer Complementary and Alternative Medicine	www.cancer.gov/cam
Society for Oncology Massage	www.s4om.org
Stewart's Caring Place: Cancer Wellness Center	www.stewartscaringplace.org
Touch, Caring and Cancer	www.partnersinhealing.net

Fertility & cancer

Alliance for Fertility Preservation	http://fertilitypreservationalliance.org
LIVESTRONG Foundation	www.livestrong.org/fertility
RESOLVE: The National Infertility Association	www.resolve.org
Save My Fertility	www.savemyfertility.org

Reimbursement & patient assistance programs

AbbVie Patient Assistance Foundation	www.abbviepaf.org, 800-222-6885
Allos Therapeutics Inc.	www.getasapinfo.com, 877-272-7102
Amgen Inc.	www.amgenassist.com, 888-427-7478
AstraZeneca	www.astrazeneca-us.com/help-affording-your-medicines, 800-292-6363
Bayer Healthcare Pharmaceuticals	866-575-5002
Boehringer Ingelheim	http://us.boehringer-ingelheim.com, 800-556-8317
Bristol-Myers Squibb	www.bms.com/products/pages/programs.aspx, 800-861-0048 Indigent Patient Assistance Program, 800-736-0003
Celgene	www.celgenepatientsupport.com, 800-931-8691
Centocor Ortho Biotech Inc.	888-222-3771
Dendreon	www.provengereimbursement.com, 877-336-3736
Eisai Inc.	www.eisaireimbursement.com, 866-613-4724
Genentech Inc.	www.gene.com/patients/patient-access, 888-249-4918
Genomic Health Inc.	www.oncotypedx.com/en-us/breast/patientscaregiversinvasive/insurance/insurance, 866-662-6897
Genzyme Corporation	www.genzyme.com/patients/patient-support-services.aspx, 800-745-4447
GlaxoSmithKline	www.gsk-access.com, 866-475-3678
ICI Pharmaceutical Novaldex	800-456-5678
Johnson & Johnson Patient Assistance	www.jjpaf.org, 800-652-6227
Lilly USA LLC	www.lillypatientone.com, 866-472-8663
Merck & Co.	www.merck.com/merckhelps, 800-727-5400
Millennium Pharmaceuticals Inc.	www.velcade.com/payingfortreatment.aspx, 866-835-2233
Novartis Pharmaceuticals	www.patientassistancenow.com, 800-245-5356
Pfizer Inc.	www.pfizerhelpfulanswers.com/pages/misc/default.aspx, 866-706-2400
Sanofi-Aventis	www.visitsponline.com, 888-847-4877
Searle Pharmaceutical Company	800-542-2526
Teva Oncology	www.tevacore.com, 888-587-3262

Lung cancer

American Lung Association	www.lung.org
Beverly Fund Lung Cancer Foundation	www.beverlyfund.org
Bonnie J. Addario Lung Cancer Foundation	www.lungcancerfoundation.org
Cancer Support Community	www.cancersupportcommunity.org
Caring Ambassadors Lung Cancer Program	www.lungcancer.org
Free To Breathe	www.freetobreathe.org
International Association for the Study of Lung Cancer	www.iaslc.org
It's Time to Focus on Lung Cancer	www.lungcancer.org
Lung Cancer Action Network	www.lungcan.org
Lung Cancer Alliance	www.lungcanceralliance.org
Lung Cancer Foundation of America	www.lcfamerica.org
Lung Cancer Online Foundation	www.lungcanceronline.org
Lung Cancer Support Community (a service of LUNGevity)	www.lungevity.org
The LUNGevity Foundation	www.lungevity.org
Uniting Against Lung Cancer	www.unitingagainstlungcancer.org

Mental health services

American Psychosocial Oncology Society Helpline	866-276-7443
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Pain management

American Chronic Pain Association	www.theacpa.org
Cancer Pain Research Consortium	admin@cancerpainresearchconsortium.org
National Foundation for the Treatment of Pain	www.nih.gov
Painfromcancer.org	www.painfromcancer.org
The Resource Center of the Alliance of State Pain Initiatives	www.trc.wisc.edu
U.S. Pain Foundation	http://uspainfoundation.org

Patient advocacy

Cancer Legal Resource Center	www.disabilityrightslegalcenter.org/cancer-legal-resource-center
Dream Foundation	www.dreamfoundation.org
For Pete's Sake Cancer Respite Foundation	www.takeabreakfromcancer.org
Foundation for Health Coverage Education	www.coverageforall.org
Friend for Life Cancer Support Network	www.friend4life.org
Gems of Hope	www.gemsofhope.com
LIVESTRONG Foundation	www.livestrong.org
LivingWell Cancer Resource Center	www.livingwellcrc.org
The Mautner Project	www.mautnerproject.org
National Coalition for Cancer Survivorship	www.canceradvocacy.org
Patient Advocate Foundation	www.patientadvocate.org
Research Advocacy Network	www.researchadvocacy.org



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For more than five decades, Lilly Oncology has been dedicated to delivering innovative solutions that improve the care of people living with cancer. Because no two cancer patients are alike, Lilly Oncology is committed to developing novel treatment approaches that accelerate the pace and progress of cancer care.

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