NCCN Guidelines for Patients®

Non-Small Cell Lung Cancer

Available online at NCCN.org/patients
Dana Reeve, sister of Deborah Morosini, MD

Turning Tragedy into Action
Deborah Morosini, MD, is a third generation physician, a pathologist, and an oncology researcher, but until her sister, Dana Reeve, was diagnosed with lung cancer, she didn’t fully comprehend how hard it can be for patients to find good information about their treatment options.

“There is a tremendous ignorance of lung cancer and about its treatments. Even I, as a physician, who works in research every day was unaware—until I had to face Dana’s tragedy.”

Dana Reeve had it all. She was a beautiful woman, an actress who married “Superman” actor Christopher Reeve. They had a son, Will. Then, in 1995, Reeve suffered a catastrophic injury in a riding accident and was paralyzed from the neck down. Dana cared for him for almost 10 years, becoming a tireless crusader for research on paralysis and stem cells. Reeve died in October, 2004 but Dana continued to press forward with her foundation and with raising her son, by then an adolescent. Then, just a few months later, this vibrant, healthy, non-smoking young woman was diagnosed with stage IV lung cancer. She lived for seven months.
Shortly after Dana’s death, Morosini began working with lung cancer advocacy groups to raise awareness of the needs of lung cancer patients. “My first thought when I was asked to speak about Dana’s experience, was ‘why do you need me?’ But then, I began to realize that the overall understanding of lung cancer is really naive. People just don’t understand the breadth and scope of the problem.”

In 2009, Sam Donaldson asked Morosini to join the Roundtable discussion that opens the NCCN Annual Conference each year. Her first acquaintance with NCCN as she says, “struck a strong chord.”

When Donaldson, as Chair of the newly formed NCCN Foundation Board, asked her to join, she accepted. In September, 2010, she agreed to have the NCCN Guidelines for Patients®: Non-Small Cell Lung Cancer named in honor and memory of her sister.

“NCCN has played a critical role in translating really complicated information into a high-quality resource. I have used the clinical guidelines on many occasions. There is a tremendous need for these new patient-friendly guidelines. The more this kind of information gets into the hands of patients, the more they will feed it back to their doctors and make informed decisions for themselves. These guidelines are extremely powerful.”

Deborah Morosini, MD
Sister of Dana Reeve
Non-Small Cell Lung Cancer

Learning that you have cancer can be overwhelming. The goal of this book is to help you get the best cancer treatment. It explains which cancer tests and treatments are recommended by experts of non-small cell lung cancer.

The National Comprehensive Cancer Network® (NCCN®) is a not-for-profit alliance of 26 of the world’s leading cancer centers. Experts from NCCN® have written treatment guidelines for lung cancer doctors. These treatment guidelines suggest what the best practice is for cancer care. The information in this patient book is based on the guidelines written for doctors.

This book focuses on the treatment of non-small cell lung cancer. Key points of the book are summarized in the NCCN Quick Guide™ series for Non-Small Cell Lung Cancer. NCCN also offers patient resources on lung cancer screening as well as other cancer types. Visit NCCN.org/patients for the full library of patient books, summaries, as well as other resources.
NCCN aims to improve the care given to patients with cancer. NCCN staff work with experts to create helpful programs and resources for many stakeholders. Stakeholders include health providers, patients, businesses, and others. One resource is the series of books for patients called the NCCN Guidelines for Patients®. Each book presents the best practice for a type of cancer. The patient books are based on clinical practice guidelines written for cancer doctors. These guidelines are called the NCCN Clinical Practice Guidelines in Oncology (NCCN Guidelines®). Clinical practice guidelines list the best health care options for groups of patients. Many doctors use them to help plan cancer treatment for their patients. Panels of experts create the NCCN Guidelines®. Most of the experts are from NCCN Member Institutions. Panelists may include surgeons, radiation oncologists, medical oncologists, and patient advocates. Recommendations in the NCCN Guidelines are based on clinical trials and the experience of the panelists. The NCCN Guidelines are updated at least once a year. When funded, the patient books are updated to reflect the most recent version of the NCCN Guidelines for doctors.

For more information about the NCCN Guidelines, visit NCCN.org/clinical.asp.

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The NCCN Foundation supports the mission of the National Comprehensive Cancer Network® (NCCN®) to improve the care of patients with cancer. One of its aims is to raise funds to create a library of books for patients. Learn more about the NCCN Foundation at NCCN.org/foundation.

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Non-Small Cell Lung Cancer

Endorsed and sponsored in part by

Lung Cancer Alliance is proud to collaborate with the National Comprehensive Cancer Network to sponsor and endorse the NCCN Guidelines for Patients®: Non–Small Cell Lung Cancer.
lungcanceralliance.org/

LUNG CANCER RESEARCH COUNCIL
As an organization that seeks to increase public awareness and understanding about lung cancer and support programs for screening and early detection, the Lung Cancer Research Council strongly supports and endorses the NCCN Guidelines for Patients.
lungcancerresearchcouncil.org/

Endorsed by

AMERICAN LUNG ASSOCIATION
The American Lung Association strongly supports efforts to help ensure all patients facing lung cancer get the highest standard of treatment and care. Helping patients understand treatment guidelines is one important step in empowering them to get the care they want and need. That is why we are pleased to endorse NCCN’s efforts to provide accessible treatment guidelines and information to patients through the NCCN Guidelines for Patients. lung.org

BONNIE J. ADDARIO LUNG CANCER FOUNDATION
The Bonnie J. Addario Lung Cancer Foundation is proud to endorse the NCCN Guidelines for Patients. We believe that educated and empowered patients do better and live longer. This book should be in the hands of every patient diagnosed with lung cancer. lungcancerfoundation.org

CARING AMBASSADORS
The Caring Ambassadors Lung Cancer Program is pleased to endorse the NCCN Guidelines for Patients with lung cancer. Patients and their loved ones need reliable resources to achieve the best possible outcome for their disease, this resource provides just that. lungcancercap.org

DUSTY JOY FOUNDATION
With patients’ best interest at heart, NCCN defines the standard of care for patients and physicians through proven scientific methods and expectations for new discoveries leading to improved patient outcomes. As a lung cancer advocacy nonprofit, our organization wholeheartedly supports NCCN Guidelines for Patients. liveLung.org

FREE ME FROM LUNG CANCER
As a lung cancer survivor and President and CEO of Free ME from Lung Cancer, I am pleased to endorse this vitally important resource so that lung cancer patients can have the information needed to make informed decisions about their treatment. freeMEfromLungCancer.org

FREE TO BREATHE
When a patient or loved one is diagnosed with lung cancer, it is important to know what treatments are available to them. The NCCN Guidelines for Patients will help patients and their caregivers locate the information they need in order to help determine the best treatment option for them. freetobreathe.org

LUNG CANCER CIRCLE OF HOPE
Lung Cancer Circle of Hope (LCCH) emphatically endorses the NCCN Guidelines for Patients. Knowledge is power and with this comprehensive resource, patients & their families can proactively work with a qualified physician to make informed decisions in the battle to conquer cancer. lungcancercircleofhope.org

LUNG CANCER INITIATIVE OF NC
As an organization specializing in connecting patients, survivors and loved ones with the medical and research community, the Lung Cancer Initiative of NC fully supports the NCCN Guidelines for Patients. These guidelines set the standards for patient education and access to care. lungcancerinitiativenc.org

LUNGevity
LUNGevity Foundation endorses the NCCN Guidelines for Patients as an excellent resource, as we strongly believe in providing education for all those affected by the disease. LUNGevity.org
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Who should read this book?

The information in this book is about cancer of the non-small cells of the lung. About 85 out of 100 patients with lung cancer have non-small cell lung cancer. Patients and those who support them—caregivers, family, and friends—may find this book helpful. It may help you discuss and decide with doctors what care is best.

Does the whole book apply to me?

This book includes information for many situations. Your treatment team can help. They can point out what information applies to you. They can also give you more information. As you read through this book, you may find it helpful to make a list of questions to ask your doctors.

Where should I start reading?

To understand your treatment options, it’s important to know how lung cancer grows and to where it spreads. As such, Part 1 is a good starting point to learn about the parts of the lungs and what lung cancer is. Part 2 addresses the process of assessing a lung mass for cancer.

If you have lung cancer, your doctors will assess how far it’s grown and spread. This is called cancer staging. Treatment options in this book are based on cancer staging. Read Part 3 for detailed information. Knowing the stage of the cancer will help you use Parts 4, 6, and 7.

Part 4 lists the tests needed to plan treatment. Some tests are used to stage the cancer. Others reveal the features of the cancer and if you can have surgery.

Parts 5 through 8 address treatment. Part 5 briefly describes cancer treatments. Part 6 is a guide to treatment options for when there is one primary tumor, and Part 7 is for multiple primary tumors. Part 8 gives tips for anyone making treatment decisions.

Making sense of medical terms

In this book, many medical words are included. These are words that you will likely hear from your treatment team. Most of these words may be new to you, and it may be a lot to learn.

Don’t be discouraged as you read. Keep reading and review the information. Don’t be shy to ask your treatment team to explain a word or phrase that you do not understand.

Words that you may not know are defined in the text or in the Dictionary. Words in the Dictionary are underlined when first used on a page.

Acronyms are also defined when first used and in the Glossary. Acronyms are short words formed from the first letters of several words. One example is CT for computed tomography.
Lung cancer basics
You’ve learned that you have or may have lung cancer. It’s common to feel shocked and confused. Part 1 reviews some basics about lung cancer that may help you start to cope. These basics may also help you start planning for treatment.

What are the lungs?

The lungs are the main organs of the respiratory system. They transfer oxygen—a gas that cells need to live—from the air into the blood. The blood then carries oxygen to all the cells in the body. The lungs also remove carbon dioxide—a gas made by cells—from the blood. Carbon dioxide is then exhaled from the lungs into the air. The transfer of these gases in and out of the body is called respiration.

When you inhale, air enters the mouth or nose and travels down the throat into the windpipe (trachea). See Figure 1.1. Air then enters the lungs through the bronchi. Within the lung, the bronchi branch off to each part (lobe) of the lung. The right lung has three lobes and the left lung has only two lobes to make space for your heart.

Within the lobes, the bronchi divide into smaller airways called bronchioli. At the end of each bronchioli are bunches of alveoli wrapped in blood vessels. The transfer of gases in and out of the blood occurs in the alveoli.
The lungs are protected by tissue called the pleura. Pleura covers each lung and helps the lungs safely rub against other organs. Pleura is made of two layers. The outer layer is known as the parietal pleura. The inner layer is called the visceral pleura. The space in between the two layers is called the pleural cavity. It is filled with a small amount of fluid called pleural fluid.

How does lung cancer start?

Cancer is a disease of cells—the building blocks of tissue in the body. Inside of cells are coded instructions for building new cells and controlling how cells behave. These instructions are called genes. Changes in genes cause normal lung cells to become cancer cells. Gene changes that are linked to lung cancer aren’t passed down from parents to children (inherited), but are caused by other factors.

Lung cancers start in the lung. Cancers that start elsewhere and then spread to the lung are not lung cancers. Almost all lung cancers are carcinomas. Carcinomas are cancers that start in cells that line the inner or outer surfaces of the body. Lung carcinomas start in cells that line the airways of the lungs.

Lung carcinomas are divided into two groups, based on how the cells look. One group is called small cell lung cancers and the other group is called non-small cell lung cancers. The second group is much more common and is the focus of this book.

Figure 1.1
Airways and the lung

The lungs transfer gases in and out of the body.
How does lung cancer spread?

Cancer cells don’t behave like normal cells in three key ways. First, the changes in genes cause normal lung cells to grow more quickly and live longer. Normal cells grow and then divide to form new cells when needed. They also die when old or damaged. In contrast, cancer cells make new cells that aren’t needed and don’t die quickly when old or damaged. Over time, cancer cells form a mass called the primary tumor.

The second way cancer cells differ from normal cells is that they can grow into (invade) other tissues. If not treated, the primary tumor can grow large and invade other tissue like a bronchus or pleura. Cancer cells can replace so many normal cells that it is hard to breathe.

Third, unlike normal cells, cancer cells can break away from the primary tumor and form new tumors. This process is called metastasis. These secondary tumors may form in nearby sites, such as another lobe of the lung. Secondary tumors can also form in distant sites, such as the other lung or the brain.

Cancer cells can spread through blood or lymph vessels that are in the lungs. Lymph is a clear fluid that gives cells water and food. It also has white blood cells that fight germs. It travels in vessels to lymph nodes. Lymph nodes are small disease-fighting organs that destroy the germs picked up by lymph.

Lymph vessels and nodes are found all over the body. See Figure 1.2. Lung cancer often first spreads to the lymph nodes in the lungs and then to the lymph nodes between the lungs.
Figure 1.2
Lymph nodes and vessels

Cancer cells can spread in the body by traveling in a fluid called lymph. Lymph surrounds the tumor then drains into vessels that connect to small disease-fighting organs, called lymph nodes.
Review

- The lungs help the body get the air it needs to live.
- The lungs are made of many small airways and sacs.
- Lung cancer often starts in the cells that line the airways.
- Cancer cells form a tumor since they don’t die as they should.
- Cancer cells can spread to other body parts through lymph or blood.
Assessing lung nodules
Many people have small masses of tissue in their lungs. These small masses are called nodules. Nodules can be caused by cancer, infections, scar tissue, and other conditions. Most nodules are not cancer.

Part 2 discusses how doctors decide if a nodule is likely cancer. If you take part in a lung cancer screening program, read the NCCN Guidelines for Patients®: Lung Cancer Screening for related information. If you aren’t in a screening program, the information in Part 2 is for you.
Team work

It takes a team of experts to decide if a nodule is cancer. Your treatment team should include a pulmonologist, thoracic radiologist, and thoracic surgeon. A pulmonologist is a doctor who’s an expert of lung diseases. A thoracic radiologist is a doctor who’s an expert of imaging tests of the chest. A thoracic surgeon is a doctor who’s an expert in operations within the chest.

Your team will assess if a lung nodule is cancer by three or four methods. One method is to assess your risk of lung cancer. Another method is to review test results for signs of cancer. A third method is to repeat tests to see if there are changes that suggest cancer is present. When doctors suspect cancer, a fourth method is used. Tissue is removed from your body and tested to confirm if cancer is present.

Your cancer risk

Chart 2.1 lists the risk factors that doctors use to assess if a nodule may be cancer. A risk factor is anything that increases your chance of lung cancer. Risk factors can be activities that people do, things in the environment, or personal traits. If one or more risk factors apply to you, it doesn’t mean you have lung cancer. Likewise, lung cancer occurs in some people who have no known risk factors.

Older age
As you get older, you are more likely to get cancer, including lung cancer. Half of the people who were diagnosed with lung cancer in recent years were 70 years old or older. Only 12 out of 100 people with lung cancer were younger than age 55.

Tobacco smoking
Tobacco smoking is the biggest risk factor for lung cancer. There are more than 50 compounds in tobacco smoke known to cause cancer. Any smoking increases your risk for lung cancer, but the more you smoke, the higher your risk. If you quit smoking, your risk will decrease. However, the risk for lung cancer is higher for former smokers than for people who never smoked. Thus, current or past tobacco smoking is a risk factor for lung cancer.

<table>
<thead>
<tr>
<th>Chart 2.1 Risk factors</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Being older in age</td>
</tr>
<tr>
<td>• Tobacco smoking</td>
</tr>
<tr>
<td>• Having had cancer</td>
</tr>
<tr>
<td>• Parent, sibling, or child who has had lung cancer</td>
</tr>
<tr>
<td>• Major contact with cancer-causing agents</td>
</tr>
<tr>
<td>• Infectious diseases of the lungs</td>
</tr>
<tr>
<td>• Having had other lung diseases</td>
</tr>
</tbody>
</table>
In 1981, a link between second-hand smoke and lung cancer was first suggested. Since then, many studies have found that second-hand smoke can cause lung cancer in people who don’t smoke. The more contact you have with second-hand smoke, the higher your risk for lung cancer.

**Having had cancer**
Your risk for lung cancer may be increased if you’ve had cancer. Having had any type of lung cancer increases your risk for other types of lung cancer. Likewise, if you’ve had a smoking-related cancer, like head and neck cancer, your risk for lung cancer is increased.

Some cancer treatments also increase risk. The risk for lung cancer increases after receiving radiation therapy in the chest for other cancers, especially if you smoke. Treatment of Hodgkin’s lymphoma with an alkylating agent—a type of cancer drug—increases the risk for lung cancer too.

**Family who’ve had lung cancer**
If a parent, sibling, or child has had lung cancer, your risk for lung cancer is higher than a person with no family history. Your risk is even higher if your relative had cancer at a young age or if more than one relative has had lung cancer.

**Cancer-causing agents**
Uranium is a substance found in rocks and soil. As it decays, a gas called radon is made and gets into air and water. Miners of uranium have a high risk of developing lung cancer. Some studies of radon found in the home have linked radon to lung cancer, while other studies have not. The risk for lung cancer may depend on how much radon is in the home. For people who’ve had major contact with radon, such as uranium miners, the risk for lung cancer is higher for those who smoke than for those who don’t smoke.

Besides radon, there are 10 other agents known to cause lung cancer. Five are metallic metals: arsenic, beryllium, cadmium, chromium, and nickel. The others are asbestos, coal smoke, soot, silica, and diesel fumes. Among people who’ve had major contact with these agents, the risk for lung cancer is higher for those who’ve smoked than for those who’ve never smoked.

**Infectious diseases**
Some infectious diseases have been linked to lung cancer. Tuberculosis is an infection caused by bacteria. If you’ve had tuberculosis, you are more likely to get lung cancer than someone who’s never had tuberculosis. The same is true if you’ve had a fungal infection in the lungs.

**Other lung diseases**
Two lung diseases have been linked to lung cancer. A history of COPD (chronic obstructive pulmonary disease) increases your risk for lung cancer. COPD makes breathing hard because the lung tissue is damaged or there’s too much mucus. The second disease linked to lung cancer is pulmonary fibrosis. Pulmonary fibrosis is major scarring of lung tissue that makes it hard to breathe.
Signs of cancer

Imaging tests make pictures of the insides of the body. CT (computed tomography) and PET (positron emission tomography) are imaging tests used to see inside the lungs. You may have had one or both of these tests. Your doctors will review the results of these tests to help to decide if a nodule may be cancer. Important test results are the features of the nodule, abnormal lung tissue, and PET hot spots.

Features of the nodule
Nodules caused by cancer have specific traits. First, they aren’t likely to have calcium buildup. Second, they often have rough edges and odd shapes. Third, they often grow faster and are larger in size than nodules without cancer. Thus, nodules that are large are more likely to be cancer than small nodules.

The density of the nodule is also assessed to decide if the nodule may be cancer. Non-solid nodules have low density. Solid nodules have high density. Part-solid nodules have both high and low areas of density. Part-solid nodules are found less often than solid nodules, but more of them are caused by cancer. On the other hand, solid nodules that are cancer grow faster than part-solid nodules that are cancer.

Abnormal lung tissue
Besides nodules, your doctors will look at your imaging results for other abnormal findings. The imaging tests may show tissue inflammation, tissue scarring, or both. The nodule is more likely to be cancer if there’s inflammation or scarring than if neither is present.

PET hot spots
PET shows how your cells are using a simple form of sugar. To create the pictures, a sugar radiotracer is put into your body. The radiotracer emits a small amount of energy that is detected by the imaging machine. Cancer appears brighter (“hotter”) in the pictures, because cancer cells use sugar more quickly than normal cells. Hot spots suggest that cancer is present.
Repeat testing

Chart 2.2 Follow-up by nodule type

<table>
<thead>
<tr>
<th>Test results</th>
<th>Follow-up care</th>
</tr>
</thead>
<tbody>
<tr>
<td>Small nodule</td>
<td>• Follow NCCN screening guidelines</td>
</tr>
<tr>
<td>Medium-sized non-solid or part-solid nodule</td>
<td>• Get LDCT in 3–6 months</td>
</tr>
<tr>
<td>Medium-sized solid nodule</td>
<td>• Consider getting PET/CT now</td>
</tr>
<tr>
<td>Large nodule</td>
<td>• See a surgeon</td>
</tr>
</tbody>
</table>

Often, the use of one imaging test detects a nodule but isn’t clear whether the nodule is cancer. Thus, tests need to be repeated to look for increases in nodule size or density over time. Such changes are likely signs of cancer.

Chart 2.2 lists the recommended care after a nodule is found based on its features. For small nodules that may be cancer, the screening guidelines recommended by NCCN should be followed. The NCCN Guidelines for Patients®: Lung Cancer Screening can be found on NCCN.org/patients. Tests repeated over time will help your doctors know if there’s cancer.

For a medium-sized solid nodule, think about getting PET with CT instead of LDCT. A PET/CT scan may find if there’s cancer quicker than LDCTs repeated over a period of time. It may also show signs of cancer spreading in the body. Some cancer centers have one machine that does both tests while other centers use two machines for PET/CT.

Nodules that are large are likely cancer. In this case, you should see a surgeon. The surgeon can remove the nodule so it can be tested for cancer.
Chart 2.3 lists the recommended care after having a LDCT. Your doctors will look to see if the nodule has increased in size or density. If no increase, three options are suggested.

First, another LDCT could be done. If cancer is present, the nodule will likely be larger or denser in 6 to 12 months. Instead of waiting, you could have a biopsy to remove tissue samples for cancer testing. A third option is surgery to remove the whole nodule. Surgery to remove the whole nodule but not much lung tissue is called an excision.

The option for a nodule that has increased in size or density is surgical excision. In this case, the nodule is very likely cancer.

**Chart 2.3 Care after LDCT**

<table>
<thead>
<tr>
<th>LDCT results</th>
<th>Options</th>
<th>Next steps</th>
</tr>
</thead>
<tbody>
<tr>
<td>No increase</td>
<td>- LDCT in 6–12 months</td>
<td>Follow NCCN screening guidelines</td>
</tr>
<tr>
<td></td>
<td>- Biopsy</td>
<td>Follow NCCN screening guidelines if cancer isn’t found</td>
</tr>
<tr>
<td></td>
<td>- Consider surgery</td>
<td>Keep reading this book if lung cancer is found</td>
</tr>
<tr>
<td>Increase</td>
<td>- Surgery</td>
<td></td>
</tr>
</tbody>
</table>

**Figure 2.1 Computed tomography (CT) machine**

A CT machine is large and has a tunnel in the middle. During the test, you will lie on a table that moves slowly through the tunnel.
Chart 2.4 lists the recommended care after having a PET/CT. If results suggest that the nodule is not likely cancer, a LDCT in 3 months followed by NCCN recommendations for lung cancer screening is an option. When the PET/CT results suggest the nodule is cancer, a biopsy to remove tissue samples for cancer testing is an option. Another option is surgical excision as described on page 19.

<table>
<thead>
<tr>
<th>PET/CT results</th>
<th>Options</th>
<th>Next steps</th>
</tr>
</thead>
<tbody>
<tr>
<td>Not likely cancer</td>
<td>• LDCT in 3 months</td>
<td>Follow NCCN screening guidelines</td>
</tr>
</tbody>
</table>
| May be cancer     | • Biopsy  
• Surgery     | Follow NCCN screening guidelines if cancer isn’t found  
Keep reading this book if lung cancer is found |
Confirming cancer

Tissue or fluid must be removed from your body and be tested to confirm (diagnose) cancer. There is no single plan for diagnosis that is best for all people. Your plan will depend on the tumor’s size, where cancer might be in your body, your health, and the experience of your doctors.

Choice of method
For lung cancers, biopsy and surgery are two methods that doctors use to remove tissue or fluid. Some people have a choice between the two methods. When deciding between methods, doctors should think about 1) how strongly they think there’s cancer; 2) where the cancer is in your body; and 3) what method you prefer.

There is more than one type of surgery and biopsy to diagnose lung cancer. They are briefly described next by broad groups. Read Part 4 for more details. Which type you will have depends partly on where the cancer is.

- **Open surgery** involves making a large cut between your ribs to spread them further apart. The whole nodule is removed by your doctor with a surgical knife. You may have open surgery when other methods won’t work or a larger piece of tissue is needed.

- **Portal surgeries** involve cutting small holes (ports) into your chest. Small tools are inserted through the ports to remove tissue. Compared to open surgery, this technique is “minimally invasive.” These surgeries include thoracoscopy and mediastinoscopy.

- **External needle biopsies** involve inserting a needle through your chest wall. The needle is guided to the site with an imaging test like CT. These biopsies include TTNA (transthoracic needle aspiration) and thoracentesis.

- **Down-the-throat biopsies** involve guiding tools down the throat into the windpipe or esophagus. Samples may be removed by needle, brush, tongs, or liquid. These biopsies include bronchoscopy and EUS (endoscopic ultrasound)-guided biopsies.

- **Phlegm biopsy** requires that you cough up some mucus (phlegm). The phlegm will be tested for cancer cells. This may be the easiest way to test for cancer but you’ll likely have another biopsy or surgery. More tissue is needed for the cancer tests discussed in Part 4.

Choice of timing
Another choice you may have is when to confirm there’s cancer. Diagnosis may occur before or at the time of surgical treatment. There may be no need to have a biopsy before treatment if your doctors strongly think a nodule’s cancer. A biopsy done beforehand would increase costs, time spent, and health risks. If confirmed at the time of surgery, tissue can be removed by biopsy or excision. More lung tissue may be removed if cancer is present.

A biopsy before treatment may be done if diagnosis during surgery would be hard or risky. Likewise, FNA (fine-needle aspiration) before treatment may be done if the cancer may not be lung cancer. FNA is done with a thin needle. A biopsy before treatment is also needed if you will receive treatment other than surgery.
Review

- It takes a team of experts to assess lung nodules for cancer.
- Tobacco smoking is the biggest risk factor for lung cancer.
- Signs of cancer can be found with imaging tests. For lung cancer, doctors assess a nodule’s features, the condition of the lung tissue, and for PET hot spots.
- Doctors assess changes in a nodule’s size and density with repeat testing. Nodules that grow fast in size or density are likely cancer.
- Testing of tissue that is removed by biopsy or surgery is needed for diagnosis.
Lung cancer staging
Cancer staging is a rating by your doctors of how far the cancer has grown and spread. Doctors plan additional tests and treatment based on how much the cancer has grown. In Part 3, the scoring system used for cancer staging is explained.

### Staging plan

Staging is very important for treatment planning. Like diagnosis, there is no single plan for staging that is best for all people. Your plan will depend on the cancer site, your health, and the experience of your doctors.

Lung cancer is often staged twice. The first staging is done before treatment and is called the **clinical stage**. Imaging tests, like CT and PET/CT, may show where the cancer has grown and spread. Blood tests should also be done. Read Part 4 for more information.

Your doctors may try to diagnose and stage the cancer at the same time. This can be done by testing the furthest site from the **nodule** that likely has cancer. Examples of such sites are **lymph nodes** and **adrenal glands**. By doing this, you’ll likely have fewer procedures.

Some cancers may not be correctly staged until after surgical treatment. For example, all the lymph nodes with cancer might not be found until surgery. This second staging is called the **pathologic stage**. For some people, lung cancer is diagnosed, staged, and treated during one operation.
TNM scores

The AJCC (American Joint Committee on Cancer) staging system is used to stage lung cancer. In this system, the letters T, N, and M describe different areas of cancer growth. Your doctors will assign a score to each letter. These scores will be combined to assign the cancer a stage.

T = Tumor
The T score tells how large or where the primary tumor has grown. Figure 3.1 shows areas of tumor growth. In medicine, tumors are measured in cm (centimeters). About 0.4 inch equals 1 cm. T scores for lung cancer include:

- **TX** tumors are too small for testing or can’t be found with tests.
- **Tis** means there are abnormal cells in the bronchi that haven’t invaded tissue.
- **T1** tumors are in the lungs only and are not larger than 3 cm.
  - **T1a** tumors are 2 cm or smaller.
  - **T1b** tumors are more than 2 cm but not larger than 3 cm.
- **T2** tumors: a) are larger than 3 cm but not larger than 7 cm; b) have grown into the bronchus but not closer than 2 cm to the carina; c) have grown into the visceral pleura; or d) have caused a partial lung collapse (atelectasis) or swelling (pneumonitis) in part of the lung.
  - **T2a** tumors are larger than 3 cm but not larger than 5 cm with or without other features, or are smaller in size with other features.
  - **T2b** tumors are larger than 5 cm but not larger than 7 cm with or without other features.
- **T3** tumors: a) are larger than 7 cm; b) have grown into the bronchus within 2 cm of the carina; c) have grown into the parietal pleura, chest wall, diaphragm, phrenic nerve, mediastinal pleura, or outer pericardium; d) have caused atelectasis or pneumonitis in the whole lung; or e) there are secondary tumors in the lobe with the primary tumor.
- **T4** tumors are scored based on invasion or the presence of secondary tumors. They: a) have grown into the mediastinum, heart or its major blood vessels, trachea, recurrent laryngeal nerve, carina, esophagus, or spine; or (b) there are secondary tumors in the lung that has the primary tumor but in a different lobe.
**N = Nodes**

Cancer cells can spread throughout the body by traveling in lymph. Lymph in lung tissue first travels to the intrapulmonary and peribronchial lymph nodes inside the lungs. From these nodes, lymph then travels to the hilar nodes. Hilar lymph nodes are found right outside the lungs where the bronchi attach. These lymph nodes are shown in Figure 3.2.

From the hilar nodes, lymph travels to lymph nodes in the mediastinum. The mediastinum is the center of the chest where the heart is. Subcarinal nodes are located right below the windpipe. Lymph also travels above the collarbone to the supraclavicular nodes and to the scalene nodes within the neck.

The N category reflects how far lung cancer has spread within the described lymph nodes. N scores for lung cancer include:

- **N0** means that there is no cancer in nearby lymph nodes.
- **N1** means that the cancer has spread to the peribronchial nodes and/or to the hilar and intrapulmonary nodes of the lung with the primary tumor.
- **N2** means that the cancer has spread to mediastinal nodes, which include subcarinal nodes, near the lung with the primary tumor.
- **N3** means that the cancer has spread to the mediastinal or hilar nodes near the lung without the primary tumor, or to any supraclavicular or scalene lymph nodes.
M = Metastasis

The M category tells you if there are metastases to distant sites. Lung cancer tends to spread to the brain, adrenal gland, and to the lung without the primary tumor. M scores for lung cancer include:

- **M0** means the cancer hasn’t spread to distant sites.
- **M1** means the cancer has spread to distant sites.
  - **M1a** means the cancer has spread: a) from one lung into the other lung; b) into the lung’s lining (pleura) and has formed secondary tumors; or c) into the fluid around the lungs or the heart.
  - **M1b** means the cancer has spread to areas outside the chest area.
Stages of lung cancer

Chart 3.1 shows the five cancer stages labeled by Roman numerals 0–IV. Occult carcinoma is also included. Occult carcinoma is the finding of cancer cells in the absence of a tumor.

The five stages are defined by TNM scores. The stages group tumors together that have a similar prognosis. A prognosis is a prediction of the pattern and outcome of a disease.

In general, earlier cancer stages have better outcomes. However, doctors define cancer stages with information from thousands of patients, so a cancer stage gives an average outcome. It may not tell the outcome for one person. Some people will do better than expected. Others will do worse. Other factors not used for staging cancer are also very important. Such factors include your general health and the type of lung cancer.
### Chart 3.1 Lung cancer stages

<table>
<thead>
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<th>ANATOMIC STAGE/PROGNOSTIC GROUPS</th>
<th>tx</th>
<th>n0</th>
<th>m0</th>
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<tr>
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<td>M0</td>
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<tr>
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<td>T1b</td>
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<tr>
<td>Stage IB</td>
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<tr>
<td>Stage IIA</td>
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<td>T1a</td>
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<td>Any N</td>
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<tr>
<td></td>
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<td>Any N</td>
<td>M1b</td>
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</tbody>
</table>

Review

• Lung cancer is grouped into stages to help plan treatment.

• The timing of and methods used for staging are not the same for everyone.

• Doctors rate the extent of cancer with T, N, and M scores.

• There are five cancer stages for lung cancer. Earlier cancers often have better outcomes.
Treatment Planning
Doctors plan treatment with many sources of information. One of these sources is tests of your health. Part 4 describes who should receive which tests. Some of these tests are used to stage the cancer and others to know which treatments would work best.

### Medical History

Your medical history includes any health events in your life and any medications you’ve taken. Doctors should collect a medical history for every person with lung cancer. Your doctor will ask about symptoms that may be related to lung cancer. Such symptoms include cough, trouble breathing, chest pain, and weight loss. Knowing which symptoms you have can help your doctors stage the cancer. Since some health problems run in families, your doctor may also ask about the medical history of your blood relatives.

### Physical exam

Doctors often give a physical exam along with taking a medical history. A physical exam is a review of your body for signs of disease. During this exam, your doctor will listen to your lungs, heart, and gut. Parts of your body will likely be felt to see if organs...
are of normal size, are soft or hard, or cause pain when touched. Your lymph nodes may feel large if the cancer has spread to them.

Your doctor will also rate your performance status. Performance status is your ability to do daily activities. It is used by doctors to assess if you can undergo certain treatments. Read Part 6 for more information.

**Blood tests**

Blood tests are done to look for signs of disease. Lung cancer can affect your blood, especially if it has spread to your bones or liver. Everyone should get blood tests early in the treatment planning process. Doctors use these tests to rate the clinical stage of cancer. The two blood tests for lung cancer are:

**CBC**

A CBC (complete blood count) measures the number of white blood cells, red blood cells, and platelets in a sample of blood. It is important to know if you have enough red blood cells to carry oxygen to your tissues, white blood cells to fight infections, and platelets to clot blood in open wounds. Your blood counts may be low because the cancer has spread into your bones or because of another health problem.

**Blood chemistry test**

Chemicals in your blood come from your liver, bone, and other organs. A blood chemistry test assesses if the chemicals in your blood are too low or high. Abnormal levels can be caused by spread of cancer or by other health problems.

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**Imaging tests**

Imaging tests allow your doctors to see inside your body without cutting it open. Doctors use these tests to stage the cancer and plan treatment. Imaging tests for lung cancer are described next.

**High-quality CT**

High-quality (or diagnostic) CT of your chest and belly area (upper abdomen) is needed for clinical staging. Higher doses of radiation are used than for LDCT. As a result, the images show more details. Imaging of your chest and upper abdomen may show if the cancer has spread to your lymph nodes, adrenal glands, liver, or other sites.

CT should be one of the first tests done in the treatment planning process. Your doctors will be better able to plan which sites to biopsy and which treatment is best. The CT scan used to assess if you can have surgery should not be older than 60 days.

**PET/CT**

If you haven’t had PET/CT, it is recommended for clinical stages I, II, and III. It’s best to have this test before a biopsy site is chosen if your doctors think the cancer is quickly spreading. PET/CT may detect cancer in the lymph nodes or other sites that wasn’t found by CT. Thus, PET/CT results may change the clinical stage of the cancer and your treatment options. The PET/CT scan used to assess if you can have surgery should not be older than 60 days.

Stage IV cancer is often found with a CT scan and has often spread to more than one site. In these cases, PET/CT isn’t needed. PET/CT may be helpful only if metastases are in one site, such as the brain or adrenal gland.

Cancer detected by PET/CT needs to be confirmed. A biopsy can be done and in some cases, another imaging test. For example, MRI (magnetic resonance
imaging), described next, of your bones may help. A biopsy of the most distant site may help with diagnosis and correctly staging the cancer.

**Brain MRI**

**MRI** is an imaging test that uses a magnetic field and radio waves to make pictures. It may show small tumors in the brain that aren’t causing symptoms. It is recommended for clinical stages IB, II, and III. If you have stage IV cancer, you may receive a brain MRI only if you have symptoms suggesting the cancer has spread to the brain. Such symptoms include unusual headaches or weakness in a specific part of your body.

For brain MRI, a device will be placed around your head that sends and receives radio waves. You may also be given a contrast dye to make the pictures clearer. It’s important to lie still during the test, so straps may be used to help you stay in place. You may be given a sedative beforehand if you feel nervous.

During MRI, you will be inside the MRI machine. The machine makes loud noises but you can wear earplugs. After MRI, you will be able to resume your activities right away unless you took a sedative. A brain MRI may cause your head to feel a bit warm.

**MRI of spine and thoracic inlet**

Some stage IIB and III lung cancers are superior sulcus tumors. This type of tumor starts at the top of the lung and easily grows into the chest wall. If this tumor has grown next to your spine or nearby blood vessels, MRI of your spine and thoracic inlet is suggested. The thoracic inlet is the center of a ring of bones at the top of the ribcage.

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**Airway tests**

To assess your airways, your doctors will perform a bronchoscopy. It is very important for diagnosis and staging. A tool, called a bronchoscope, will be used to see inside your lungs and collect samples. Common types of bronchoscopy are described below.

Bronchoscopy is recommended for clinical stages I, II, and IIIA before treatment is started. A bronchoscopy is very rarely done if there is stage IIIB or IV disease. If your doctors strongly think a nodule is cancer, you might not need a bronchoscopy until the day of your surgery. It should be done right before the surgery as one procedure. Doing so saves money and time, and reduces health risks.

**Standard bronchscopy**

To perform this test, part of the bronchoscope will be inserted into your body. This part looks like a thin, long tube about as thick as a pencil. It has a light, camera, and open channel. The light and camera allow your doctor to guide the tube down your nose or mouth and into your lungs. A small brush, needle, or tongs can be inserted into the open channel to collect samples. Also, liquid may be sprayed into the airway and then sucked back up.

There are two types of standard bronchoscopes. A rigid bronchoscope is straight and doesn’t bend. A flexible bronchoscope is thinner and longer and can bend. It can reach the smaller airways of the lung. General anesthesia is needed for a rigid bronchoscopy. Local anesthesia is used for a flexible bronchoscopy. After the biopsy, you may feel some swelling and sound hoarse.

**Radial EBUS bronchscopy**

Radial EBUS (endobronchial ultrasound) bronchoscopy uses a flexible bronchoscope that is fitted with an ultrasound device. Ultrasound uses high-frequency sound waves to make pictures of the
insides of the body. Your doctor will move the device back and forth to see a 360-degree view of the area on a computer. The ultrasound device will then be removed so that the sampling tool can be inserted.

**Navigational bronchoscopy**
The airways of the lungs get smaller as they extend toward the sides of the body. Flexible bronchoscopes are often too large to travel through these small airways. A navigational bronchoscopy uses a flexible bronchoscope that is fitted with a second open channel that is thinner and longer. For this test, your doctor will first plan how to reach the cancer site using CT. Your doctor will then guide the bronchoscope to the site with a sensor that will be inserted through an open channel. When the site is in reach, the sensor will be removed and the sampling tool will be inserted.

**Cancer spread tests**
Most people with lung cancer will have a biopsy of their lymph nodes or other distant sites. The clinical stage, based on prior tests, will be used to decide which sites to biopsy. Biopsy results may change the clinical stage.

The area between your two lungs is called the mediastinum. This area has lymph nodes. Lung cancer is more likely to have spread to these nodes when the tumor is larger and closer to this spot. As such, testing of mediastinal nodes may not be needed for stage IA. These nodes should be tested if the cancer is clinical stage IB, II, or IIIA.

Stage IIIB cancers have either N2 or N3 disease. A mediastinal biopsy may be the best test to get. For others, a test of your supraclavicular or scalene lymph nodes might be better to confirm N3 disease.

For clinical stage I and II cancers, you might not need a mediastinal biopsy until the day of your surgery. It should be done right before the surgery as one procedure. Doing so saves money and time, and reduces health risks. On the other hand, a mediastinal biopsy may be done before the day of surgery if there’s a strong chance of N2 or N3 disease (stage III). It may also be done beforehand if tissue can’t be tested for cancer during the operation.

If imaging or other tests suggest stage IV, the presence of cancer needs to be confirmed before treatment. A mediastinal test is very rarely done for stage IV cancers. A needle biopsy of your adrenal gland may be done to check for cancer. Some lung cancers spread into the fluid around the lungs or heart. If this has likely happened, a biopsy of the fluid should be done.

There are many ways to biopsy lymph nodes and other sites. Navigational bronchoscopy, described
before, is one way to access mediastinal nodes. Other common types of biopsies are described next.

**TTNA**

**TTNA** (transsthoracic needle aspiration) can be used to biopsy certain lung nodules and also some lymph nodes. This test is also called a percutaneous needle biopsy. A very thin needle will be inserted through your chest wall to get a tissue sample.

Before inserting the needle, your skin will be cleaned and numbed with local anesthesia. Next, a small cut will be made into your skin. The needle will be inserted through the cut and into the nodule by your doctor. An imaging test should be used to help guide the needle to the right spot.

During the biopsy, you may be asked to stay still and hold your breath at times. After the biopsy, the cut will be bandaged and you will be given a chest x-ray to check the results. After TTNA, you may feel sore and have some redness at the needle site.

**Mediastinoscopy**

This biopsy accesses lymph nodes in the middle of the chest with a mediastinoscope. A mediastinoscope is very much like a bronchoscope. A cut right above your breastbone will be made to insert the mediastinoscope into your body. When a cut alongside the breastbone is made, the biopsy is called a Chamberlain mediastinoscopy. This method allows access to lymph nodes on the left side of your chest. General anesthesia will be used for these biopsies. You may have some pain and swelling and a small scar afterward.

**EBUS-TBNA**

**EBUS-TBNA** (endobronchial ultrasound-guided transbronchial needle aspiration) can access mediastinal nodes. A flexible bronchoscope fitted with an ultrasound device will be guided down your trachea. For this biopsy, the device doesn’t need to be removed in order to insert the sampling tool. Once the bronchoscope is in place, a needle will be inserted through the bronchus and into a lymph node to obtain a sample. EBUS-TBNA requires local anesthesia.

**EUS-FNA**

Food passes from the mouth into the stomach through the esophagus. The esophagus extends lower into the body than the bronchi. Thus, lymph nodes below the bronchi can be accessed through the esophagus. For **EUS-FNA** (endoscopic ultrasound-guided fine-needle aspiration), a bronchoscope will be guided down your esophagus. Ultrasound is used to help find the right spot. A needle will then be inserted through your esophagus and into a lymph node to obtain a sample. Local anesthesia is used to prevent pain.

**Thoracentesis**

When cancer spreads into the fluid around the lungs, it can cause a buildup of fluid. This excess fluid is called plural effusion. Fluid samples can be removed with thoracentesis. First, anesthesia will be injected into your skin. Then, a needle will be inserted between your ribs and into your chest cavity to remove fluid. The fluid will be assessed with a microscope to see if there are cancer cells. If cancer isn’t found by thoracentesis, a thoracoscopy may be done.

**Pericardiocentesis**

Pericardiocentesis is much like thoracentesis. Like the lungs, there is fluid around the heart. Excess fluid may build up if cancer invades it. This excess fluid is called pericardial effusion. Pericardiocentesis removes the excess fluid with a needle inserted through your chest wall. You will receive local anesthesia beforehand.

**Thoracoscopy**

This procedure can obtain samples of N2 and N3 disease as well as fluid from around the lungs and
Treatment planning Cancer lab tests

heart. It requires **general anesthesia**. A thoracoscope will be inserted through a cut between your ribs. Thoracoscopes work much like bronchoscopes allowing doctors to see any abnormal tissue. Samples can be collected with different types of tools. This surgery may cause some pain and swelling and will leave a small scar. This test is also called a **VATS** (video-assisted thoracic surgery).

### Cancer lab tests

Samples from the **biopsy** or surgery will be sent to a **pathologist**. A pathologist is a doctor who’s an expert in testing cells to find disease. He or she will examine the samples using a microscope.

If cancer cells are found, more tests will be done. All of the test results are recorded in a pathology report. It’s a good idea to get a copy of your pathology report. It’s used to plan treatment.

The pathologist will study the parts of the cancer cells to classify the disease. This is called histologic typing. The pathology report will state if the cancer started in the lung or elsewhere. If the cancer started in the lung, the report will also list the type of lung cancer.

Histologic subtypes of **non-small cell lung cancer** include **squamous cell carcinoma**, **adenocarcinoma**, **large-cell lung carcinoma**, and other rare types. Squamous cells are thin and flat and line the airways of the lung. Adenocarcinoma is a cancer of epithelial cells that make fluids to keep the lungs moist. Large-cell lung carcinomas lack features to classify them as any other carcinoma.

The pathologist also helps assess how far the cancer has grown and spread. He or she will measure the size of the **primary tumor**. **Lymph nodes** and other removed tissue will be studied for cancer cells. If you have surgery, tests will be done to see if there are cancer cells at the edge of the removed tissue. If so, you will likely need more treatment.

**Molecular testing**

Another task of pathologists is to do **molecular testing**. Molecular testing looks for cancer-related changes in **genes** for which there are treatments. Molecular testing is used to plan treatment for lung cancers that have spread to more than one area outside the chest. These cancers include stage IV.
Molecular testing is recommended for widespread adenocarcinomas, large-cell lung carcinomas, and other rare types. Very few people with squamous cell carcinoma have known gene changes for which treatments are available. Therefore, molecular testing of widespread squamous cell carcinoma can be considered, especially for people who never smoked and for mixed histology.

Molecular testing is done with biopsy samples. Thus, you may have more than one biopsy to collect enough cells. Molecular testing should look for the following gene changes:

Overactive EGFR mutations. EGFR (epidermal growth factor receptor) is a surface receptor. A surface receptor is a protein in the outer membrane of cells that starts changes within a cell when turned on. Changes (mutations) in the gene that controls EGFR cause the receptors to be overactive. EGFR overactivity causes new cancer cells to form quickly. Very rarely, another mutation, called KRAS, may be present and stop treatment for overactive EFGRs from working.

ALK gene rearrangement. For some lung cancers, the growth of the cancer cells is caused in part by an ALK (anaplastic lymphoma kinase) gene rearrangement. A gene rearrangement is the fusion of one gene with another gene to create a new gene. In some lung cancers, ALK fuses with EML4. The ALK-EML4 fusion gene makes proteins that help lung cancer cells grow.

There are other known gene changes linked with non-small cell lung cancer, but they are rare. Molecular testing for these gene changes should be done along with EGFR and ALK. There may be treatments available or a clinical trial you could join. Read Part 5 for more information.

Other gene changes linked with lung cancer include:

- BRAF V600E mutation,
- HER2 mutations,
- MET amplification,
- ROS1 rearrangements, and
- RET rearrangements.

Proteomic testing
Proteomic testing can assess for patterns of proteins related to lung cancer. This testing is done when first-line treatment doesn’t work for metastatic disease. Test results help doctors plan what treatment will be best for you. Read Part 6.4 for more information.

Lung function tests
Lung surgery and radiation therapy are treatment options for stage I and II, and some stage III and IV tumors. To assess if you can have these treatments, your doctors will need to know how well your lungs work. There are three lung (or pulmonary) function tests. A common side effect of these tests is shortness of breath.

- Spirometry involves blowing into a tube to measure how much air and how fast you breathe.
- A gas diffusion test involves breathing in a harmless gas and measuring how much you breathe out. It tells how much oxygen travels from your lungs into your blood.
- Body plethysmograph involves sitting in a small room and breathing into a tube. This test measures how much air your lungs can hold and how much air is left in your lungs after you exhale.
My notes
Review

- A medical history, physical exam, and blood tests can reveal signs of cancer.
- High-quality CT shows more details than LDCT and may show where the cancer has spread. PET/CT may detect cancer that CT did not.
- MRI can be used to see if the cancer has spread to your brain. You may also have an MRI of your spine and thoracic inlet if you have a superior sulcus tumor.
- A bronchoscopy involves a tool that is guided into your airways to find and collect samples for cancer testing.
- There are many ways to biopsy lymph nodes and other sites to which lung cancer might have spread. Which biopsy you will receive partly depends on where the imaging tests show the cancer to be.
- Pathologists are doctors who conduct lab tests on body tissue or fluid to find disease. Lab tests can reveal if you have cancer, the type of cancer, and the cancer stage. Pathologists also do molecular testing. These tests look for cancer-related changes in genes for which there may be treatment.
- Pulmonary function tests help doctors assess if surgery or radiation therapy is a treatment option.
Overview of cancer treatments
There is more than one treatment for lung cancer. The main types are described on the next pages. This information may help you understand Parts 6 and 7. It may also help you know what to expect during treatment. Not every person with lung cancer will receive every treatment listed.

Surgery

Removal of the tumor by surgery is the time-honored way to try to cure lung cancer. It is preferred over other local treatments. It is commonly used to treat stages I, II, and some III cancers, but rarely used for stage IV. If you will have surgery, a board-certified thoracic surgeon who treats lung cancer often should be on your treatment team.

Lung surgery methods

Removal of a lung tumor can sometimes be done with one of two methods. The classic method is thoracotomy. Thoracoscopy, also called VATS, is a newer method. It is also used to do biopsies as described in Part 4. Not enough research has been done to know if one method is better than the other.

Before either surgery, you will be asked to stop eating, drinking, and taking some medicines for a short period of time. If you smoke, it is important to stop. General anesthesia is used for both surgeries.
With thoracotomy, a large cut is made from the front of the chest to the back passing under the armpit and shoulder blade. The cut is made between the ribs and through the chest wall. The ribs are spread apart with retractors to allow the surgeon to work. Sometimes, a part of the rib is removed. During surgery, the lung with the tumor is deflated and a breathing tube is inserted down the throat to assist the other lung. After surgery, the cut is sewn closed, but chest tubes are left in place for a few days to drain fluid and air. The surgery can take between 2 and 6 hours to complete. You may stay in the hospital for a few days to recover.

With thoracoscopy, three or four small cuts are made between the ribs on the side of the chest. A small camera and surgical tools are inserted through the cuts. Video from the camera is shown on a screen so that the surgeon can clearly see your organs. Tissue is removed through the small cuts rather than a large opening as done for thoracotomy. During surgery, the lung with the tumor is deflated and a breathing tube is inserted down the throat to assist the other lung. After surgery, the cuts are sewn closed, but chest tubes are left in place for a few days to drain fluid and air. The surgery can take between 2 and 3 hours to complete. You may stay in the hospital for a few days to recover.

**Lung surgery types**

As shown in Figure 5.1, how much lung tissue is removed during surgery can differ. Some surgeries for lung cancer remove only part of, rather than the whole lung. Names of common lung surgeries are:

- **Wedge resection** – Removal of a small part of a lobe,
- **Segmentectomy** – Removal of a large part of a lobe,
- **Lobectomy** – Removal of an entire lobe,

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**Figure 5.1. Lung tumor surgeries.** How much lung tissue will be removed during surgery partly depends on the size of the tumor. Part of a lobe, a whole lobe, or an entire lung may be removed.

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• **Sleeve lobectomy** – Removal of an entire lobe and part of the bronchus, and
• **Pneumonectomy** – Removal of the entire lung.

The goal of surgery is to remove all the cancer from the body. To do so, the tumor is removed, along with some normal-looking tissue around its rim, called the **surgical margin**. Thus, which surgery you will have depends on where the tumor has grown and how well your lungs work.

The preferred surgery for most lung cancers is a pneumonectomy or lobectomy. If a sleeve lobectomy and pneumonectomy are options, a sleeve lobectomy is preferred because it saves most of the lung. You may qualify for a **segmentectomy** and wedge resection if a lobectomy would seriously threaten your health or if you have a very small tumor that hasn’t likely spread. If you can have either surgery, a segmentectomy is the preferred choice.

### Lymph node surgery

During the surgery to remove the tumor, lymph nodes with cancer and those that may have cancer are removed. Lymph nodes may be removed by systematic **lymph node sampling** or **lymph node dissection**.

For sampling, some lymph nodes in the lung and some **mediastinal nodes** are removed. A lymph node dissection removes as many lymph nodes as possible from the lung and mediastinum. To remove nodes, some organs may need to be moved or cut.

If you have N0 or N1 disease, either type of surgery is an option. Lymph node dissection of the mediastinal nodes is recommended for stage IIIA tumors with N2 disease that are treated with surgery.

### Side effects of surgery

**Side effects** are unhealthy or unpleasant physical or emotional responses to treatment. You may experience side effects from the general anesthesia, lung tumor surgery, or the lymph node surgery. Side effects of general anesthesia include a sore throat from the breathing tube, nausea with vomiting, confusion, muscle aches, and itching.

Common side effects of any surgery are pain, swelling, and scars. Pain can be intense after lung surgery. Pain and swelling often fade away in the weeks following surgery. Numbness near the surgical area may be long-lasting. There is a chance of infection, which may cause pneumonia. There’s also a chance for a collapsed lung (pneumothorax).

Not all side effects of surgery are listed here. Please ask your treatment team for a complete list of common and rare side effects. If a side effect bothers you, tell your treatment team. There may be ways to help you feel better.

### Ablation

**Ablation** destroys small tumors with little harm to nearby tissue. It isn’t used often for lung cancer. It may be used for small tumors. Radiofrequency ablation kills cancer cells using heat from electrodes that are passed through a **bronchoscope**. This treatment is done by an interventional **radiologist**.
Radiation therapy uses high-energy rays to treat cancer. The rays damage DNA (deoxyribonucleic acid). DNA is a chain of chemicals in cells that contains genes. This either kills the cancer cells or stops new cancer cells from being made. Radiation can also harm normal cells. As a result, new methods keep being made that target the tumor more precisely.

The current standard of radiation therapy is described next. Radiation can be used to treat or control lung cancer. A board-certified radiation oncologist who treats lung cancer often should be on your treatment team if you may have radiation therapy.

**Radiation methods**

Radiation therapy can be given with either one of two methods. The first method is called EBRT (external beam radiation therapy). For EBRT, a machine outside the body delivers radiation. Radiation is often given in a series of sessions for about 6 weeks. This is the more common method used to treat lung cancer.

The other method is internal radiation therapy (also called brachytherapy). Internal radiation therapy involves placing a radioactive object in or near the tumor. For lung cancer, internal radiation can shrink a tumor blocking an airway. Radiation is given through a plastic tube that is inserted into the airway. The tube is removed after the treatment session.

**Receiving EBRT**

To receive radiation therapy, you first must have a simulation session. For simulation, pictures of the tumor are taken. CT scans are suggested for simulation, but 4D-CT (four-dimensional computed tomography) is ideal to account for tumor movement from breathing. Contrast can improve scans of tumors in the inner two-thirds of the lung or of lymph nodes with cancer. A PET/CT scan can help to aim radiation beams when the lung has collapsed or contrast can’t be used. PET/CT scans within 4 weeks of treatment are suggested. If your breathing causes large movements, motion control methods during the scans may be used.

Using the scans, your treatment team will plan the best radiation dose, number and shape of radiation beams, and number of treatment sessions. Beams are shaped with computer software and hardware added to the radiation machine. Radiation beams are aimed at the tumor with help from ink marks on the skin or marker seeds in the tumor.

During treatment, you will lie on a table in the same position as done for simulation. Devices may be used to keep you from moving. You will be alone while the technician operates the machine from a nearby room.

He or she will be able to see, hear, and speak with you. As treatment is given, you may hear noises. One session takes less than 10 minutes.
The types of EBRT include:

- **3D-CRT (three-dimensional conformal radiation therapy)** – Treatment is completed in about 6 weeks and uses photon beams that match the shape of the tumor,

- **IMRT (intensity-modulated radiation therapy)** – Treatment is completed in about 6 weeks and uses photon beams of different strengths based on the thickness of the tumor,

- **SABR (stereotactic ablative radiotherapy)** – Treatment is completed in 1 to 2 weeks and uses precise, high-dose photon beams,

- **Hadron therapy** – Treatment is completed in about 6 weeks and uses proton beams that deliver radiation mostly within the tumor,

- **SRS (stereotactic radiosurgery)** – Treatment is completed in 1 to 2 weeks and uses precise, high-dose photon beams to treat brain tumors, and

- **WBRT (whole brain radiation therapy)** – Treatment is completed in 2 weeks and uses small amounts of radiation to treat the entire brain.

A lung tumor is harder to target than some other tumors in the body. This is because breathing causes the tumor to move. IGRT (image-guided radiation therapy) can improve how well the radiation beam targets the tumor. IGRT uses a machine that delivers radiation and also takes pictures of the tumor. Pictures can be taken right before or during treatment. These pictures are compared to the ones taken during simulation. If needed, changes will be made to your body position or the radiation beams.

**Side effects of radiation**

The most common side effects of radiation therapy are changes in skin. Your treated skin will look and feel as if it has been sunburned. It will likely become red and may also become dry, sore, and feel painful when touched. You may also have hair loss. Other side effects of radiation include swelling of the lungs or esophagus, extreme tiredness despite sleep, and loss of appetite.

Not all side effects of radiation are listed here. Please ask your treatment team for a complete list of common and rare side effects. If a side effect bothers you, tell your treatment team. There may be ways to help you feel better.
Supportive care doesn’t aim to treat cancer but aims to improve quality of life. However, supportive care given with cancer treatment has been shown not only to improve quality of life and mood but also to extend life among people newly diagnosed with stage IV lung cancer.

Supportive care is also called palliative care. It can address many needs. One example is treatment for physical and emotional symptoms. As such, you may receive denosumab or zoledronic acid to strengthen bones. Mesna may be given to protect against the side effects of chemotherapy. Ask your treatment team for other ways to treat symptoms.

Supportive care can also help with treatment decisions as you may have more than one option. It can also help with coordination of care between health providers. Talk with your treatment team to plan the best supportive care for you.
Chemotherapy

Chemotherapy, or “chemo,” is the use of drugs to kill cancer cells. Some chemotherapy drugs kill cancer cells by damaging their DNA or disrupting the making of DNA. Other drugs interfere with cell parts that are needed for making new cells. Thus, no new cells are made to replace dying cells.

Many chemotherapy drugs work when cells are in an active growth phase. During the active growth phase, cells grow and divide to form a new cell. Chemotherapy drugs that disrupt the growth phase work well for cancer cells that are growing and dividing quickly. Other chemotherapy drugs work whether cells are in a growth or resting phase. Chemotherapy can kill both cancer and normal cells.

Most chemotherapy drugs for lung cancer are liquids that are slowly injected into a vein. Some are a pill that is swallowed. The drugs travel in the bloodstream to treat cancer throughout the body. The drugs used to treat lung cancer are listed in Chart 5.1.

Chemotherapy is given in cycles of treatment days followed by days of rest. This allows the body to recover before the next cycle. Cycles vary in length depending on which drugs are used. Often, a cycle is 14, 21, or 28 days long.

Chemotherapy may consist of one or more drugs. When only one drug is used, it is called a single agent. However, not all drugs work the same way, so often more than one drug is used. A combination regimen is the use of two or more chemotherapy drugs. Often, cisplatin or carboplatin—drugs made with platinum—is used with another drug. These regimens are called platinum-doublet chemotherapy.

Part 6 is a guide that explains who should receive which treatments. You will learn if chemotherapy may be part of your treatment. The drugs which are used with surgery and radiation therapy are listed next.

You may receive chemotherapy before or after surgery. In this case, cisplatin is most often used along with another drug. The other drug may be vinorelbine, etoposide, vinblastine, gemcitabine, docetaxel, or pemetrexed. If these regimens make you too sick, paclitaxel with carboplatin is an option.

Chemotherapy is sometimes given with radiation therapy. When given at the same time, cisplatin with either etoposide or vinblastine are options. Pemetrexed with either cisplatin or carboplatin may be used for lung cancers that aren’t squamous cell carcinomas. When chemotherapy is followed by radiation therapy, cisplatin with vinblastine or paclitaxel with carboplatin is used.

Chemotherapy may be given during and after radiation therapy. In this case, paclitaxel with carboplatin is used. Another option is cisplatin with etoposide.

Side effects of chemotherapy

The reactions to chemotherapy differ. Some people have many side effects. Others have few. Some side effects can be very serious while others can be unpleasant but not serious.

Side effects of chemotherapy depend on the drug type, amount taken, length of treatment, and the person. In general, side effects are caused by the death of fast-growing cells. These cells are found in the blood, gut, hair follicles, and mouth. Thus, common side effects of chemotherapy include low blood cell counts, not feeling hungry, nausea, vomiting, diarrhea, hair loss, and mouth sores.

Not all side effects of chemotherapy are listed here. Please ask your treatment team for a complete list of common and rare side effects. If a side effect bothers you, tell your treatment team. There may be ways to help you feel better.
### Chart 5.1 Drug treatment for lung cancer

<table>
<thead>
<tr>
<th>Generic name</th>
<th>Brand name (sold as)</th>
<th>Type of treatment</th>
</tr>
</thead>
<tbody>
<tr>
<td>Afatinib</td>
<td>Gilotrif®</td>
<td>Targeted therapy</td>
</tr>
<tr>
<td>Bevacizumab</td>
<td>Avastin®</td>
<td>Targeted therapy</td>
</tr>
<tr>
<td>Cabozantinib</td>
<td>Cometriqâ</td>
<td>Targeted therapy</td>
</tr>
<tr>
<td>Carboplatin</td>
<td>–</td>
<td>Chemotherapy</td>
</tr>
<tr>
<td>Ceritinib</td>
<td>Zykadia™</td>
<td>Targeted therapy</td>
</tr>
<tr>
<td>Cisplatin</td>
<td>Platinol®</td>
<td>Chemotherapy</td>
</tr>
<tr>
<td>Crizotinib</td>
<td>Xalkori®</td>
<td>Targeted therapy</td>
</tr>
<tr>
<td>Dabrafenib</td>
<td>Tafinlari®</td>
<td>Targeted therapy</td>
</tr>
<tr>
<td>Denosumab</td>
<td>Xgeva™</td>
<td>Bone health</td>
</tr>
<tr>
<td>Docetaxel</td>
<td>Taxotere®</td>
<td>Chemotherapy</td>
</tr>
<tr>
<td>Erlotinib hydrochloride</td>
<td>Tarceva®</td>
<td>Targeted therapy</td>
</tr>
<tr>
<td>Etoposide; Etoposide phosphate</td>
<td>Etopophos® Preservative Free</td>
<td>Chemotherapy</td>
</tr>
<tr>
<td>Gemcitabine hydrochloride</td>
<td>Gemzar®</td>
<td>Chemotherapy</td>
</tr>
<tr>
<td>Ifosfamide</td>
<td>–</td>
<td>Chemotherapy</td>
</tr>
<tr>
<td>Irinotecan hydrochloride</td>
<td>Camptosar®</td>
<td>Chemotherapy</td>
</tr>
<tr>
<td>Mesna</td>
<td>Mesnex® Injection</td>
<td>Chemoprotectant</td>
</tr>
<tr>
<td>Mitomycin; Mitomycin C</td>
<td>–</td>
<td>Chemotherapy</td>
</tr>
<tr>
<td>Nivolumab</td>
<td>Opdivo®</td>
<td>Immunotherapy</td>
</tr>
<tr>
<td>Paclitaxel</td>
<td>Taxol®</td>
<td>Chemotherapy</td>
</tr>
<tr>
<td>Paclitaxel, albumin bound</td>
<td>Abraxane®</td>
<td>Chemotherapy</td>
</tr>
<tr>
<td>Pemetrexed</td>
<td>Alimta®</td>
<td>Chemotherapy</td>
</tr>
<tr>
<td>Ramucirumab</td>
<td>Cyramza™</td>
<td>Targeted therapy</td>
</tr>
<tr>
<td>Trastuzumab</td>
<td>Herceptin®</td>
<td>Targeted therapy</td>
</tr>
<tr>
<td>Vemurafenib</td>
<td>Zelboraf®</td>
<td>Targeted therapy</td>
</tr>
<tr>
<td>Vinblastine sulfate</td>
<td>–</td>
<td>Chemotherapy</td>
</tr>
<tr>
<td>Vinorelbine tartrate</td>
<td>Navelbine®</td>
<td>Chemotherapy</td>
</tr>
<tr>
<td>Zoledronic acid</td>
<td>Zometa®</td>
<td>Bone health</td>
</tr>
</tbody>
</table>
Targeted therapy

Targeted therapy is a class of drugs that stops the action of molecules that help cancer cells grow. It is less likely to harm normal cells than chemotherapy. Most of the time, molecular testing is used to know if targeted therapy would be helpful.

As discussed in Part 4, EGFR and ALK molecular testing should be done for some widespread lung cancers. For EGFR mutations, erlotinib or afatinib are approved treatments. Both of these drugs block the signals from EGFRs that tell the cancer cells to grow.

For an ALK gene rearrangement, crizotinib is first used. If crizotinib fails, ceritinib is used next. These drugs block the signals from ALKs that tell the cancer cells to grow.

Cancer cells need the food (nutrients) and oxygen in blood to grow. Thus, cancer cells send out signals, called VEGF (vascular endothelial growth factor). These signals cause new blood vessels to grow into the tumor. Bevacizumab and ramucirumab block growth signals from attaching to cells that make new blood vessels. Thus, new blood vessels that are needed to feed cancer cells do not form. Bevacizumab and ramucirumab are used with chemotherapy to treat some widespread lung cancers. Read Part 6.4 for more information.

Although rare, there are other changes in genes that have been linked to lung cancer. There is treatment for some of these changes. These treatments are approved for lung or other cancers but still need more research. Such treatments include afatinib and trastuzumab for HER2 mutations. Cabozantinib targets RET gene rearrangements. In addition to targeting ALK rearrangement, crizotinib targets ROS1 gene rearrangements and when there are too many MET genes (amplification). Both dabrafenib and vemurafenib target the BRAF V600E mutation.

Targeted therapy drugs are received either as an injection into a vein or as a pill to be swallowed. The drugs travel in the bloodstream to treat cancer throughout the body. Your treatment team will give you more information on how to take these medicines.

Side effects of targeted therapy

Like chemotherapy, the side effects of targeted therapy depend on the drug and dose. Side effects can differ even when treating the same target. Common and severe side effects are listed next for treatments that target EGFR, ALK, and VEGF.

Common side effects of afatinib include diarrhea, skin rash or dryness, acne, nail infection, mouth sores, itching, and not feeling hungry. Diarrhea and skin problems may be severe. Likewise, you may also have lung, liver, heart, and eye problems.

Common side effects of erlotinib are rash; diarrhea; nausea; vomiting; not feeling hungry; feeling tired despite sleep; trouble breathing; and cough. You may have severe eye, skin, lung, kidney, liver problems, but these are rare. Other rare events include holes in your gut, bleeding, and blood clots.

Common side effects of crizotinib include vision problems; nausea; stomach problems (vomiting, diarrhea, constipation); fluid buildup; and feeling tired despite sleep. Severe problems may include lung, liver, and heart problems. Ceritinib often causes stomach problems; belly pain; feeling tired despite sleep; and not feeling hungry. Stomach problems may be severe. Other severe events may include liver, lung, and heart problems.

Common side effects of bevacizumab are nose bleeds; headache; high blood pressure; sore inner nose; too much protein in urine; changes in taste; dry skin; bleeding in rectum; teary eyes; back pain; and scaly skin. Less common, but severe problems that
may occur are holes in your gut; wounds that don't heal; bleeding; abnormal passages in body; kidney damage; and heart and sight problems.

Common side effects of ramucirumab are high blood pressure and diarrhea. Serious side effects include bleeding; blood clots; holes in the gut; abnormal passage between body parts; and slow wound healing.

Not all side effects of targeted therapy are listed here. Please ask your treatment team for a complete list of common and rare side effects. If a side effect bothers you, tell your treatment team. There may be ways to help you feel better.

Immunotherapy

The immune system is the body's natural defense against infection and disease. The immune system includes many chemicals and proteins. These chemicals and proteins are made naturally in your body.

Immunotherapy increases the activity of your immune system. By doing so, it improves your body's ability to find and destroy cancer cells. Nivolumab is a new immunotherapy used for lung cancer.

Cancer cells sometimes send signals that stop T-cells of the immune system from attacking them. Nivolumab attaches to T-cells to block these signals. Thus, T-cells are able to attack cancer cells.

Common side effects of nivolumab are feeling tired despite sleep; trouble breathing; muscle, bone, and joint pain; not feeling hungry; cough; nausea; and constipation. Severe problems with your lungs, gut, liver, kidney, and hormones may occur.
Clinical trials

New tests and treatments aren’t offered to the public as soon as they’re made. They need to be studied. A clinical trial is a type of research that studies a test or treatment. Clinical trials study how safe and helpful tests and treatments are. When found to be safe and helpful, they may become tomorrow’s standard of care. Because of clinical trials, the tests and treatments in this book are now widely used to help people with lung cancer.

New tests and treatments go through a series of clinical trials to make sure they’re safe and that they work. Without clinical trials, there is no way to know if a test or treatment is safe or helpful. Clinical trials have four phases. Examples of the four phases for treatment are:

- **Phase I trials** – aim to find the best dose of a new drug with the fewest side effects.

- **Phase II trials** – assess if a drug works for a specific type of cancer.

- **Phase III trials** – compare a new drug to the standard treatment.

- **Phase IV trials** – test new drugs approved by the U.S. FDA (Food and Drug Administration) in many patients with different types of cancer.

Joining a clinical trial has benefits. First, you’ll have access to the most current cancer care. Second, you will receive the best management of care. Third, the results of your treatment—both good and bad—will be carefully tracked. Fourth, you may help other patients with cancer.

Clinical trials have risks, too. Like any test or treatment, there may be side effects. Also, new tests or treatments may not help. Another downside may be that paperwork or more trips to the hospital are needed.

To join a clinical trial, you must meet the conditions of the study. Patients in a clinical trial are often alike in terms of their cancer and general health. This is to know that any progress is because of the treatment and not because of differences between patients. To join, you’ll need to review and sign a paper called an informed consent form. This form describes the study in detail, including the risks and benefits.

Ask your treatment team if there is an open clinical trial that you can join. There may be clinical trials where you’re getting treatment or at other treatment centers nearby. You can also find clinical trials through the websites listed in Part 7.
CAM (Complementary and Alternative Medicine) is a group of treatments that aren’t often given by doctors. There is much interest today in CAM for cancer. Many CAMs are being studied to see if they are truly helpful.

Complementary medicines are treatments given along with usual medical treatments. While CAMs aren’t known to kill cancer cells, they may improve your comfort and well-being. Two examples are acupuncture for pain management and yoga for relaxation.

Alternative medicine is used in place of usual medicine. Some alternative medicines are sold as cures even though they haven’t been proven to work. If there was good proof that CAMs or other treatments cured cancer, they would be included in this book.

It is important to tell your treatment team if you are using any CAMs. They can tell you which CAMs may be helpful and which CAMs may limit how well medical treatments work.
### Review

- Lung surgery removes the tumor with some normal tissue around its edge.
- Lymph node surgery removes nodes with cancer and nodes that may have cancer.
- Radiation kills cancer cells or stops new cancer cells from being made.
- Chemotherapy drugs stop the growth process of cells.
- Targeted therapy drugs stop cancer cells from getting food or signals to grow.
- Immunotherapy activates your body’s disease-fighting system to destroy cancer cells.
- Clinical trials give people access to new tests and treatments.
Treatment guide:
One primary tumor
6 Treatment guide: One primary tumor

58 6.1 Stage I treatments

In stage IA, the lung tumor is 3 cm or smaller. A stage IB tumor can be as large as 5 cm or may have grown into the main airway or tissue lining of the lung.

62 6.2 Stage II treatments

A stage IIA tumor is 3 cm or smaller with cancer in the lung’s lymph nodes. Larger stage IIA tumors are between 5.1 and 7 cm but the cancer hasn’t spread to any nodes. Stage IIA tumors have not invaded nearby tissue.

A stage IIB tumor can also be as large as 7 cm but the lung’s nodes have cancer. Stage IIB tumors also include those larger than 7 cm without cancer in the lymph nodes, those that have invaded the chest wall or bronchi, or those with secondary tumors in the same lobe.

68 6.3 Stage III treatments

Stage IIIA is often defined by cancer spread to mediastinal nodes, presence of secondary tumors, or tumor growth into the mediastinum, neck, or spine. Stage IIIB is often defined by cancer that has spread to lymph nodes in or near the other lung or above the collarbone.

78 6.4 Stage IV treatments

Stage IV cancer has spread to distant sites within the chest or to sites outside the chest. Distant sites within the chest include the other lung, the pleura, and the fluid around the lungs or heart. The options listed in Part 6.4 also apply to lung cancer that reappeared on tests after prior treatment and has metastasized.

86 Review
Part 6 is a guide to the treatment options for people with one primary non-small cell lung tumor. This information is taken from the treatment guidelines written by NCCN experts for lung cancer doctors. The aim is to cure or control the cancer. Receiving supportive care is also important. Your doctors may suggest other treatments than those listed in Part 6 based on your health and personal wishes.

Treatment options in Part 6 are listed by cancer stage. Cancer is staged based on tests given before treatment. This is called the clinical stage. To learn your options for initial treatment, read the part that is a match to the clinical stage. For example, if the cancer is stage II, read Part 6.2.

You may have surgery for initial treatment. During surgery, your doctors may find more cancer than first thought. This may change the stage of the cancer. The cancer stage based on surgery results is called the pathologic stage. If the cancer is upstaged, read the part that is a match to the pathologic stage. For example, if the cancer was upstaged from stage II to stage III, read Part 6.3 to learn your treatment options following surgery.
### 6.1 Stage I treatments

#### Chart 6.1.1 Initial treatment

<table>
<thead>
<tr>
<th>Surgery status</th>
<th>Treatment options</th>
</tr>
</thead>
<tbody>
<tr>
<td>You are approved and agree</td>
<td>• Lung tumor and lymph node surgery</td>
</tr>
<tr>
<td>You are not approved or decline</td>
<td>• Radiation therapy (including SABR)</td>
</tr>
</tbody>
</table>

#### Chart 6.1.2 Treatment after initial surgery

<table>
<thead>
<tr>
<th>Cancer stage</th>
<th>Margin status</th>
<th>Treatment options</th>
</tr>
</thead>
<tbody>
<tr>
<td>Stage IA</td>
<td>No cancer in the margins</td>
<td>• Start survivorship care plan</td>
</tr>
<tr>
<td></td>
<td>Cancer in the margins</td>
<td>• Surgery (preferred)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Radiation therapy</td>
</tr>
<tr>
<td>Stage IB</td>
<td>No cancer in the margins</td>
<td>• Start survivorship care plan</td>
</tr>
<tr>
<td></td>
<td>Cancer in the margins</td>
<td>• Surgery (preferred) ± chemotherapy</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Radiation therapy ± chemotherapy</td>
</tr>
</tbody>
</table>

#### Chart 6.1.3 Treatment after initial radiation therapy

<table>
<thead>
<tr>
<th>Cancer stage</th>
<th>Treatment options</th>
</tr>
</thead>
<tbody>
<tr>
<td>Stage IA</td>
<td>• Start survivorship care plan</td>
</tr>
<tr>
<td>Stage IB</td>
<td>• Consider chemotherapy if cancer may still be in your body</td>
</tr>
</tbody>
</table>
**Chart 6.1.1** lists the options for initial treatment of stage I lung cancer. Which initial treatment you will have depends on if you are able to have surgery. If lung surgery is an option, removal of the tumor and lymph nodes is recommended. The goal of surgery is to cure the cancer.

If you are unable or refuse to have surgery, you may be treated with radiation therapy. The goal of radiation therapy is to cure the cancer. You may receive conventional radiation therapy. Conventional radiation therapy gives radiation in small doses for weeks and targets both the tumor and some normal tissue. One example is 3D-CRT. A newer type of radiation therapy—SABR—is also recommended. Ablation may be another option for some stage IA tumors in the outer third of the lung.

**Chart 6.1.2** lists the options for treatment following surgery. You may receive more treatment depending on the surgical results. Treatment options are based on whether the cancer is stage IA or IB. Cancer in the surgical margin also affects treatment options.

A cancer-free surgical margin is often a sign that all the cancer was removed. In this case, you may start your survivorship care plan. However, the chance of remaining cancer cells is higher for some stage IB cancers. Signs that cancer cells may remain include tumors larger than 4 cm, having a wedge resection, or if the cancer cells barely look like normal cells. In these cases, chemotherapy may be received.

When cancer is found in the surgical margins, a second surgery is the preferred treatment. Radiation therapy is another option. If you have stage IB cancer, chemotherapy may be added to surgery or radiation therapy.

**Chart 6.1.3** lists the care options after radiation therapy that is given as initial treatment. For stage IA, no more treatment is needed. You may start your survivorship care plan.

The chance of remaining cancer cells is higher for some stage IB cancers. Signs that cancer cells may remain include tumors larger than 4 cm and if the cancer cells barely look like normal cells. In these cases, chemotherapy may be received.
Chart 6.1.4 lists recommendations for your survivorship care plan. These plans start when treatment is done and tests show no signs of cancer. The plan should address your whole health and well-being. Talk with your doctor about making a plan together.

Follow-up cancer tests are given to find any new lung tumors early. A medical history, physical exam, and chest CT scan with or without contrast should be received every 6 to 12 months for 2 years. If results are normal, it is suggested that you have these tests once a year. The yearly scan should be a LDCT given without contrast.

Besides follow-up tests, tests of your general health are recommended. After going through treatment for cancer, it may be hard to think about taking care of "less important" issues. However, your general health can have a big impact on your well-being. Have your blood pressure, cholesterol, and glucose checked on a regular basis. Some people also need bone density testing.

Likewise, take steps to prevent other diseases. Such steps can include getting immunization shots for the flu, herpes, and other diseases. Dental cleaning and exams on a regular basis can prevent disease, too. Screening tests for other cancers is also very important.

The last recommendation is to start or keep a healthy lifestyle. There is proof that healthy behaviors can improve your treatment results. Limiting your use of alcohol, protecting yourself from the sun, and being at a healthy weight are important.

<table>
<thead>
<tr>
<th>Type of care</th>
<th>Schedule of care</th>
</tr>
</thead>
<tbody>
<tr>
<td>Medical history and physical exam</td>
<td>• Every 6–12 months for 2 years</td>
</tr>
<tr>
<td></td>
<td>◦ If normal results, then repeat every year</td>
</tr>
<tr>
<td>Chest CT ± contrast</td>
<td>• Every 6–12 months for 2 years</td>
</tr>
<tr>
<td></td>
<td>◦ If normal results, then LDCT without contrast</td>
</tr>
<tr>
<td></td>
<td>every year</td>
</tr>
<tr>
<td>General health tests (eg, bone density)</td>
<td>• As needed</td>
</tr>
<tr>
<td>Prevent other diseases (eg, cancer screening)</td>
<td>• As needed</td>
</tr>
<tr>
<td>Healthy lifestyle (eg, healthy diet, no smoking)</td>
<td>• As needed</td>
</tr>
</tbody>
</table>

Chart 6.1.4 Survivorship care plan
Healthy eating includes eating a balanced diet, eating the right amount of food, and drinking enough fluids. However, you may have special food needs during and after treatment. A nutritionist—an expert in creating a healthy diet—can help.

Many patients benefit from some exercise. Exercise tones muscles, lowers stress, and improves health. Exercise programs differ between people based on their needs. Talk with your treatment team about which exercises would be best for you.

Being hooked on nicotine is one of the hardest addictions to stop. The stress of lung cancer may make it harder or easier to quit. Quitting is important since smoking can limit how well cancer treatment works. Talk with your treatment team about ways to quit.
6.2 Stage II treatments

No invasion by tumor

**Chart 6.2.1 Initial treatment**

<table>
<thead>
<tr>
<th>Surgery status</th>
<th>Cancer stage</th>
<th>Treatment options</th>
</tr>
</thead>
<tbody>
<tr>
<td>You are approved and agree</td>
<td>Any stage II</td>
<td>• Lung tumor and lymph node surgery</td>
</tr>
<tr>
<td>You are not approved or decline</td>
<td>Stage II with N0 disease</td>
<td>• Radiation therapy (including SABR)</td>
</tr>
<tr>
<td></td>
<td>Stage II with N1 disease</td>
<td>• Chemoradiation (at the same time)</td>
</tr>
</tbody>
</table>

**Chart 6.2.2 Treatment after initial surgery**

<table>
<thead>
<tr>
<th>Cancer stage</th>
<th>Margin status</th>
<th>Treatment options</th>
</tr>
</thead>
<tbody>
<tr>
<td>Stage IIA with scores of: T2b, N0, M0</td>
<td>No cancer in the margins</td>
<td>• Start survivorship care plan</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Chemotherapy if cancer may still be in your body</td>
</tr>
<tr>
<td></td>
<td>Cancer in the margins</td>
<td>• Surgery (preferred) ± chemotherapy</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Chemoradiation (same time or back-to-back)</td>
</tr>
<tr>
<td>Stage IIA or IIB with scores of: T1a, N1, M0</td>
<td>No cancer in the margins</td>
<td>• Chemotherapy</td>
</tr>
<tr>
<td>T1b, N1, M0 T2a, N1, M0 T2b, N1, M0</td>
<td>Cancer in margins that is only seen with a microscope</td>
<td>• Surgery + chemotherapy</td>
</tr>
<tr>
<td>T3, N0, M0</td>
<td></td>
<td>• Chemoradiation (same time or back-to-back)</td>
</tr>
<tr>
<td></td>
<td>Cancer in margins that is seen with the naked eye</td>
<td>• Surgery + chemotherapy</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Chemoradiation (at the same time)</td>
</tr>
</tbody>
</table>

**Chart 6.2.3 Treatment after initial radiation therapy**

<table>
<thead>
<tr>
<th>Cancer stage</th>
<th>Treatment options</th>
</tr>
</thead>
<tbody>
<tr>
<td>Stage II with N0 disease</td>
<td>• Consider chemotherapy if cancer may still be in your body</td>
</tr>
</tbody>
</table>
Part 6.2 has four sections: No invasion by tumor, Superior sulcus tumors, Other invasive tumors, and Survivorship care plan. The first section lists options for primary tumors that have not grown into the chest wall or bronchi. Among stage II cancers, only those scored T3, N0, M0 may have invaded these sites but not all do. The second and third sections list options for invasive T3 tumors. The last section addresses care after treatment for all stage II cancers.

Chart 6.2.1 lists options for initial treatment of stage II tumors without invasion. Which initial treatment you will have depends on if you are able to have surgery. If lung surgery is an option, removal of the tumor and lymph nodes is recommended. The goal of surgery is to cure the cancer. If you are likely to have chemotherapy after surgery, another option is to have it before surgery to shrink the tumor.

If you are unable or refuse to have surgery, options depend on if the cancer has spread to your lymph nodes. If not (N0), you may be treated with radiation therapy. The goal of radiation therapy is to cure the cancer. You may receive conventional radiation therapy. Conventional radiation therapy gives radiation in small doses for weeks and targets both the tumor and some normal tissue. One example is 3D-CRT. A newer type of radiation therapy—SABR—is also recommended.

Tests may have found cancer in your intrapulmonary, peribronchial, or hilar lymph nodes. This is scored as N1 disease. For N1 disease, you may receive chemoradiation. The two types of treatment should be received at the same time.

Chart 6.2.2 lists the options for treatment following surgery. You may receive more treatment depending on the surgical results. Treatment options differ by cancer stages. Cancer in the surgical margin also affects treatment options.

For tumors scored T2b, N0, M0, a cancer-free margin is often a sign that all the cancer was removed. In this case, you may start your survivorship care plan. However, the chance of remaining cancer cells is higher for some of these cancers. Signs that cancer cells may remain include tumors larger than 4 cm, having a wedge resection, or if the cancer cells barely look like normal cells. In these cases, chemotherapy may be received.

Some T2b, N0, M0 tumors will be removed with cancer in the margins. In these cases, a second surgery with or without chemotherapy is preferred. However, chemoradiation is a second option. The two types of treatment may be given at the same time or back-to-back. For all other stage II cancers, chemotherapy is recommended when the margins are cancer-free.

When the margins have cancer, options are based on if the cancer can been seen only with a microscope or with the naked eye. In either case, a second surgery followed by chemotherapy is an option. The second option for microscopic cancer is chemoradiation. These two types of treatment may be given at the same time or back-to-back. Chemoradiation may also be used to treat cancer seen with the naked eye. In this case, the two types of treatment should be received at the same time.

Chart 6.2.3 lists the options for treatment after initial radiation therapy. The chance of remaining cancer cells is higher for some stage II cancers. Signs that cancer cells may remain include tumors larger than 4 cm and if the cancer cells barely look like normal cells. In these cases, chemotherapy may be received.
Superior sulcus tumors

Chart 6.2.4 Treatment

<table>
<thead>
<tr>
<th>Surgery status</th>
<th>Treatment options</th>
</tr>
</thead>
<tbody>
<tr>
<td>You are approved and agree</td>
<td>Chemoradiation (at the same time), then surgery, then chemotherapy</td>
</tr>
<tr>
<td>You are not approved or decline</td>
<td>Chemoradiation (at the same time)</td>
</tr>
</tbody>
</table>

Other invasive tumors

Chart 6.2.5 Initial treatment

<table>
<thead>
<tr>
<th>Surgery status</th>
<th>Treatment options</th>
</tr>
</thead>
<tbody>
<tr>
<td>You are approved and agree</td>
<td>• Surgery (preferred)</td>
</tr>
<tr>
<td></td>
<td>• Chemoradiation (at the same time) followed by surgery</td>
</tr>
<tr>
<td></td>
<td>• Chemotherapy followed by surgery</td>
</tr>
<tr>
<td>You are not approved or decline</td>
<td>• Chemoradiation (at the same time)</td>
</tr>
</tbody>
</table>

Chart 6.2.6 Treatment after surgery

<table>
<thead>
<tr>
<th>Prior treatment</th>
<th>Margin status</th>
<th>Treatment options</th>
</tr>
</thead>
<tbody>
<tr>
<td>Surgery only</td>
<td>No cancer in the margins</td>
<td>• Chemotherapy</td>
</tr>
<tr>
<td></td>
<td>Cancer in margins that is only seen with a microscope</td>
<td>• Surgery + chemotherapy</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Chemoradiation (same time or back-to-back)</td>
</tr>
<tr>
<td>Chemoradiation or chemotherapy</td>
<td>Cancer in margins that is seen with the naked eye</td>
<td>• Surgery + chemotherapy</td>
</tr>
<tr>
<td>or chemotherapy followed by surgery</td>
<td></td>
<td>• Chemoradiation (at the same time)</td>
</tr>
<tr>
<td></td>
<td>No cancer in the margins</td>
<td>• Start survivorship care plan</td>
</tr>
<tr>
<td></td>
<td>Cancer in margins</td>
<td>• Surgery</td>
</tr>
</tbody>
</table>
Chart 6.2.4 lists the treatment for superior sulcus tumors. A superior sulcus tumor starts at the top of the lung and easily grows into the chest wall. Chemoradiation is used to shrink the tumor to make surgery easier. After surgery, chemotherapy is recommended. If you are unable or refuse to have surgery, chemoradiation is an option. The two types of treatment should be received at the same time.

Chart 6.2.5 lists options for initial treatment for other stage IIB invasive tumors. These tumors have grown into the chest wall or bronchi, but the cancer hasn’t spread to lymph nodes. Surgery alone is the preferred option.

Other options are chemoradiation or chemotherapy to shrink the cancer before surgery. If you are unable or refuse to have surgery, chemoradiation is an option. The two types of treatment should be received at the same time.

Chart 6.2.6 lists the options for treatment following surgery. You may receive more treatment depending on the surgical results. Treatment options differ by which treatment you had before. Cancer in the surgical margin also affects treatment options.

If you only had surgery, chemotherapy is recommended when the surgical margins are cancer-free. When the margins have cancer, a second surgery followed by chemotherapy is an option. Chemoradiation is a second option. These two types of treatment may be given at the same time or back-to-back if the cancer can only been seen with a microscope. If seen with the naked eye, the two treatment types should occur at the same time.

You may have had chemoradiation or chemotherapy before surgery. In this case, you may start your survivorship care plan if the margins are cancer-free. Otherwise, a second surgery to remove the cancer is recommended.
Survivorship care plan

**Chart 6.2.7 Recommendations**

<table>
<thead>
<tr>
<th>Type of care</th>
<th>Schedule of care</th>
</tr>
</thead>
<tbody>
<tr>
<td>Medical history and physical exam</td>
<td>• Every 6–12 months for 2 years</td>
</tr>
<tr>
<td></td>
<td>◦ If normal results, then repeat every year</td>
</tr>
<tr>
<td>Chest CT ± contrast</td>
<td>• Every 6–12 months for 2 years</td>
</tr>
<tr>
<td></td>
<td>◦ If normal results, then LDCT without contrast</td>
</tr>
<tr>
<td></td>
<td>◦ every year</td>
</tr>
<tr>
<td>General health tests (eg, bone density)</td>
<td>• As needed</td>
</tr>
<tr>
<td>Prevent other diseases (eg, cancer screening)</td>
<td>• As needed</td>
</tr>
<tr>
<td>Healthy lifestyle (eg, exercise, no smoking)</td>
<td>• As needed</td>
</tr>
</tbody>
</table>

**Chart 6.2.7** lists recommendations for your survivorship care plan. These plans start when treatment is done and tests show no signs of cancer. The plan should address your whole health and well-being. Talk with your doctor about making a plan together.

Follow-up cancer tests are given to find any new lung tumors early. A [medical history, physical exam, and chest CT scan](https://www.nccn.org/professionals/physician_gls/pdf/pulmonary.pdf) with or without [contrast](https://www.nccn.org/professionals/physician_gls/pdf/pulmonary.pdf) should be received every 6 to 12 months for 2 years. If results are normal, it is suggested that you have these tests once a year. The yearly scan should be a [LDCT](https://www.nccn.org/professionals/physician_gls/pdf/pulmonary.pdf) given without contrast.

Besides follow-up tests, tests of your general health are recommended. After going through treatment for cancer, it may be hard to think about taking care of “less important” issues. However, your general health can have a big impact on your well-being. Have your blood pressure, cholesterol, and glucose checked on a regular basis. Some people also need bone density testing.

Likewise, take steps to prevent other diseases. Such steps can include getting immunization shots for the flu, herpes, and other diseases. Dental cleaning and exams on a regular basis can prevent disease, too. Screening tests for other cancers is also very important.
The last recommendation is to start or keep a healthy lifestyle. There is proof that healthy behaviors can improve your treatment results. Limiting your use of alcohol, protecting yourself from the sun, and being at a healthy weight are important.

Healthy eating includes eating a balanced diet, eating the right amount of food, and drinking enough fluids. However, you may have special food needs during and after treatment. A nutritionist—an expert in creating a healthy diet—can help.

Many patients benefit from some exercise. Exercise tones muscles, lowers stress, and improves health. Exercise programs differ between people based on their needs. Talk with your treatment team about which exercises would be best for you.

Being hooked on nicotine is one of the hardest addictions to stop. The stress of lung cancer may make it harder or easier to quit. Quitting is important since smoking can limit how well cancer treatment works. Talk with your treatment team about ways to quit.
6.3 Stage III treatments

No invasion by tumor

N0 or N1 disease

**Chart 6.3.1  Initial treatment**

<table>
<thead>
<tr>
<th>Surgery status</th>
<th>Treatment options</th>
</tr>
</thead>
<tbody>
<tr>
<td>You are approved and agree</td>
<td>• Lung tumor and lymph node surgery</td>
</tr>
<tr>
<td>You are not approved or decline</td>
<td>• Chemoradiation (at the same time)</td>
</tr>
</tbody>
</table>

**Chart 6.3.2  Treatment after initial surgery**

<table>
<thead>
<tr>
<th>Margin status</th>
<th>Treatment options</th>
</tr>
</thead>
<tbody>
<tr>
<td>No cancer in the margins</td>
<td>• Chemotherapy</td>
</tr>
<tr>
<td>Cancer in margins that is only seen with a microscope</td>
<td>• Chemoradiation (same time or back-to-back)</td>
</tr>
<tr>
<td>Cancer in margins that is seen with the naked eye</td>
<td>• Chemoradiation (at the same time)</td>
</tr>
</tbody>
</table>
Part 6.3 has four sections: *No invasion by tumor*, *Superior sulcus tumors*, *Other invasive tumors*, and *Survivorship care plan*. The first section lists options for primary tumors that have not grown into the *chest wall*, *bronchi*, or *mediastinum*. The second and third sections list options for tumors that have invaded these sites. The last section addresses care after treatment for all stage II cancers.

**Chart 6.3.1** lists options for initial treatment for N0 and N1 disease. N0 means that no cancer has been found in *lymph nodes*. N1 means that cancer has been found in *peribronchial*, *intrapulmonary*, or *hilar nodes* of the lung with the primary tumor.

Which initial treatment you will have depends on if you are able to have surgery. If lung surgery is an option, removal of the tumor and lymph nodes is recommended. The goal of surgery is to cure the cancer. If you are likely to have chemotherapy after surgery, another option is to have it before surgery to shrink the tumor. If you are unable or refuse to have surgery, you may receive *chemoradiation*. The two types of treatment should be given at the same time.

**Chart 6.3.2** lists the options for treatment following surgery. Treatment options are based on if there’s cancer in the *surgical margin*. If not, chemotherapy is an option. If there’s cancer, chemoradiation may be received. The two treatment types may be given at the same time or back-to-back if the cancer can only be seen with a microscope. If seen with the naked eye, both treatment types should occur at the same time.
### Chart 6.3.3 Treatment after prior surgery

<table>
<thead>
<tr>
<th>Lymph node status</th>
<th>Margin status</th>
<th>Treatment options</th>
</tr>
</thead>
<tbody>
<tr>
<td>N2 disease was found</td>
<td>No cancer in the margins</td>
<td>• Chemoradiation (back-to-back)</td>
</tr>
<tr>
<td></td>
<td>Cancer in margins that is only seen with a microscope</td>
<td>• Chemoradiation (same time or back-to-back)</td>
</tr>
<tr>
<td></td>
<td>Cancer in margins that is seen with the naked eye</td>
<td>• Chemoradiation (at the same time)</td>
</tr>
</tbody>
</table>

### Chart 6.3.4 Initial treatment

<table>
<thead>
<tr>
<th>Cancer stage</th>
<th>Surgery status</th>
<th>Treatment options</th>
</tr>
</thead>
<tbody>
<tr>
<td>Stage IIIA</td>
<td>You’re not approved or decline</td>
<td>• Chemoradiation (at the same time)</td>
</tr>
<tr>
<td></td>
<td>You may be approved</td>
<td>• Chemotherapy ± radiation therapy</td>
</tr>
<tr>
<td>Stage IIIB</td>
<td>–</td>
<td>• Chemoradiation (at the same time)</td>
</tr>
</tbody>
</table>

### Chart 6.3.5 Treatment after chemotherapy ± radiation therapy

<table>
<thead>
<tr>
<th>Treatment results</th>
<th>Treatment options</th>
</tr>
</thead>
<tbody>
<tr>
<td>No cancer growth</td>
<td>• Surgery followed by radiation therapy if not received before ± chemotherapy</td>
</tr>
<tr>
<td>Local growth only</td>
<td>• Radiation therapy if not received before ± chemotherapy</td>
</tr>
</tbody>
</table>
The charts on page 70 list treatments for stage III (N2 or N3) tumors without invasion. N2 means that the cancer has spread to the mediastinal lymph nodes. Cancer that has spread to the lymph nodes near the lung without the primary tumor or to the supraclavicular or scalene nodes is scored N3.

Chart 6.3.3 lists the options for treatment following prior surgery. Sometimes N2 disease is only found after surgical treatment. Options are based on if there’s cancer in the surgical margin. If not, chemotherapy is an option.

If there’s cancer in the margins, chemoradiation may be received. The two treatments may be given at the same time or back-to-back if the cancer can only been seen with a microscope. If seen with the naked eye, both treatment types should occur at the same time.

Chart 6.3.4 lists options for N2 or N3 disease found before treatment started. Options for initial treatment differ on whether the cancer is stage IIIA or IIIB.

Chemoradiation is an option for all stage IIIA cancers. The two types of treatment should occur at the same time. Some stage IIIA cancer may be able to be removed by surgery. In these cases, chemotherapy with or without radiation therapy may be first received.

For stage IIIB, chemoradiation is recommended. The two types of treatment should be given at the same time.

Chart 6.3.5 lists options following chemotherapy with or without radiation therapy. If this treatment stops cancer growth, surgery can be done. After surgery, you may have chemotherapy followed by radiation therapy if you didn’t have it before. If there’s cancer growth in or near the lung, radiation therapy (if you didn’t have it before) with or without chemotherapy is recommended.
Superior sulcus tumors

Chart 6.3.6 Initial treatment

<table>
<thead>
<tr>
<th>Surgery status</th>
<th>Treatment options</th>
</tr>
</thead>
<tbody>
<tr>
<td>You are approved and agree</td>
<td>Chemoradiation (at the same time)</td>
</tr>
<tr>
<td>You may be approved</td>
<td>Chemoradiation (at the same time)</td>
</tr>
<tr>
<td>You are not approved or decline</td>
<td>Chemoradiation (at the same time)</td>
</tr>
</tbody>
</table>

Chart 6.3.7 Treatment after chemoradiation

<table>
<thead>
<tr>
<th>Surgery status</th>
<th>Treatment options</th>
</tr>
</thead>
<tbody>
<tr>
<td>You are approved and agree</td>
<td>Surgery followed by more chemotherapy</td>
</tr>
<tr>
<td>You are still not approved because the tumor is too big</td>
<td>Complete radiation therapy followed by more chemotherapy</td>
</tr>
<tr>
<td>You are not approved or decline</td>
<td>Start survivorship care plan</td>
</tr>
</tbody>
</table>

Chart 6.3.6 lists the initial treatment for superior sulcus tumors. A superior sulcus tumor starts at the top of the lung and easily grows into the chest wall. Tumors with a T3 score are likely to be treatable with surgery. Tumors with T4 scores may or may not be able to be treated with surgery. Chemoradiation will be used to either shrink the tumor before surgery or to try to cure the cancer. The two types of treatment should be received at the same time.

Chart 6.3.7 lists treatment options following chemoradiation. You may have surgery followed by chemotherapy if the tumor is now small enough. If the tumor is still too big, radiation therapy to try to cure the cancer should be completed and more chemotherapy should follow. If you aren’t able or refuse to have surgery, you may start your survivorship care plan.
### Chart 6.3.8 Initial treatment

<table>
<thead>
<tr>
<th>Surgery status</th>
<th>Treatment options</th>
</tr>
</thead>
<tbody>
<tr>
<td>You are approved and agree</td>
<td>Surgery (preferred)</td>
</tr>
<tr>
<td></td>
<td>Chemoradiation (at the same time) followed by surgery</td>
</tr>
<tr>
<td></td>
<td>Chemotherapy followed by surgery</td>
</tr>
<tr>
<td>You are not approved or decline</td>
<td>Chemoradiation (at the same time)</td>
</tr>
</tbody>
</table>

### Chart 6.3.9 Treatment after surgery

<table>
<thead>
<tr>
<th>Prior treatment</th>
<th>Margin status</th>
<th>Treatment options</th>
</tr>
</thead>
<tbody>
<tr>
<td>Surgery only</td>
<td>No cancer in the margins</td>
<td>Chemotherapy</td>
</tr>
<tr>
<td></td>
<td>Cancer in margins that is only seen with a microscope</td>
<td>Surgery + chemotherapy</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Chemoradiation (same time or back-to-back)</td>
</tr>
<tr>
<td></td>
<td>Cancer in margins that is seen with the naked eye</td>
<td>Surgery + chemotherapy</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Chemoradiation (at the same time)</td>
</tr>
<tr>
<td>Chemoradiation or chemotherapy followed by</td>
<td>No cancer in the margins</td>
<td>Start survivorship care plan</td>
</tr>
<tr>
<td>surgery</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Cancer in margins</td>
<td>Surgery</td>
</tr>
</tbody>
</table>
**Chart 6.3.8** lists options for initial treatment for other stage III invasive tumors. These tumors have grown into the chest wall, bronchi, or mediastinum. The cancer may or may not have spread to lymph nodes.

Surgery alone is the preferred option. Other options are chemoradiation or chemotherapy to shrink the cancer before surgery. If you are unable or refuse to have surgery, chemoradiation is an option. The two types of treatment should be received at the same time.

**Chart 6.3.9** lists the options for treatment following surgery. You may receive more treatment depending on the surgical results. Treatment options differ by which treatment you had before. Cancer in the surgical margin also affects treatment options.

If you only had surgery, chemotherapy is recommended when the surgical margins are cancer-free. When the margins have cancer, a second surgery followed by chemotherapy is an option. Chemoradiation is a second option. These two types of treatment may be given at the same time or back-to-back if the cancer can only been seen with a microscope. If seen with the naked eye, the two treatment types should occur at the same time.

You may have had chemoradiation or chemotherapy before surgery. In this case, you may start your survivorship care plan if the margins are cancer-free. Otherwise, a second surgery to remove the cancer is recommended.
Survivorship care plan

Chart 6.3.10 Recommendations

<table>
<thead>
<tr>
<th>Type of care</th>
<th>Schedule of care</th>
</tr>
</thead>
<tbody>
<tr>
<td>Medical history and physical exam</td>
<td>• Every 6–12 months for 2 years</td>
</tr>
<tr>
<td></td>
<td>◦ If normal results, then repeat every year</td>
</tr>
<tr>
<td>Chest CT ± contrast</td>
<td>• Every 6–12 months for 2 years</td>
</tr>
<tr>
<td></td>
<td>◦ If normal results, then LDCT without contrast every year</td>
</tr>
<tr>
<td>General health tests (eg, bone density)</td>
<td>• As needed</td>
</tr>
<tr>
<td>Prevent other diseases (eg, cancer screening)</td>
<td>• As needed</td>
</tr>
<tr>
<td>Healthy lifestyle (eg, healthy diet, no smoking)</td>
<td>• As needed</td>
</tr>
</tbody>
</table>

Chart 6.3.10 lists recommendations for your survivorship care plan. These plans start when treatment is done and tests show no signs of cancer. The plan should address your whole health and well-being. Talk with your doctor about making a plan together.

Follow-up cancer tests are given to find any new lung tumors early. A medical history, physical exam, and chest CT scan with or without contrast should be received every 6 to 12 months for 2 years. If results are normal, it is suggested that you have these tests once a year. The yearly scan should be a LDCT given without contrast.

Besides follow-up tests, tests of your general health are recommended. After going through treatment for cancer, it may be hard to think about taking care of “less important” issues. However, your general health can have a big impact on your well-being. Have your blood pressure, cholesterol, and glucose checked on a regular basis. Some people also need bone density testing.

Likewise, take steps to prevent other diseases. Such steps can include getting immunization shots for the flu, herpes, and other diseases. Dental cleaning and exams on a regular basis can prevent disease, too. Screening tests for other cancers is also very important.
The last recommendation is to start or keep a healthy lifestyle. There is proof that healthy behaviors can improve your treatment results. Limiting your use of alcohol, protecting yourself from the sun, and being at a healthy weight are important.

Healthy eating includes eating a balanced diet, eating the right amount of food, and drinking enough fluids. However, you may have special food needs during and after treatment. A nutritionist—an expert in creating a healthy diet—can help.

Many patients benefit from some exercise. Exercise tones muscles, lowers stress, and improves health. Exercise programs differ between people based on their needs. Talk with your treatment team about which exercises would be best for you.

Being hooked on nicotine is one of the hardest addictions to stop. The stress of lung cancer may make it harder or easier to quit. Quitting is important since smoking can limit how well cancer treatment works. Talk with your treatment team about ways to quit.
6.4 Stage IV treatments

Overactive EGFR mutation

Chart 6.4.1 First-line treatment

<table>
<thead>
<tr>
<th>Performance status</th>
<th>Treatment options</th>
</tr>
</thead>
<tbody>
<tr>
<td>Any</td>
<td>• Erlotinib or afatinib</td>
</tr>
</tbody>
</table>

Chart 6.4.2 Second-line treatment

<table>
<thead>
<tr>
<th>Symptoms</th>
<th>Tumor location</th>
<th>Number of tumors</th>
<th>Treatment options</th>
</tr>
</thead>
<tbody>
<tr>
<td>No</td>
<td>Anywhere</td>
<td>Any</td>
<td>• Stay on erlotinib or afatinib</td>
</tr>
<tr>
<td>Yes</td>
<td>Brain</td>
<td>1</td>
<td>• Consider local treatment and stay on targeted therapy</td>
</tr>
<tr>
<td></td>
<td></td>
<td>2 or more</td>
<td>• Consider WBRT and stay on targeted therapy</td>
</tr>
<tr>
<td></td>
<td>Anywhere except brain</td>
<td>1</td>
<td>• Consider local treatment and stay on targeted therapy</td>
</tr>
<tr>
<td></td>
<td></td>
<td>2 or more</td>
<td>• Start treatment for histologic type ± targeted therapy</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>• Adenocarcinomas, Large cell, Unknown</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>• Squamous cell carcinomas</td>
</tr>
</tbody>
</table>

Stage IV includes cancers that are scored M1a or M1b. If you have stage IV cancer, talk with your treatment team about starting supportive care early. Supportive care has been shown to extend and enhance life.

For M1a disease, the cancer has spread from one lung to the other, into the pleura, or into the fluid around the lung or heart. Some of these cancers may be able to be treated with surgery, radiation therapy, or both.

For M1b disease, the lung cancer has spread to sites beyond the chest area. Very rarely, lung cancer spreads to only one site beyond the chest. Examples of such sites are the adrenal gland or brain. In these cases, it may be possible to treat the lung tumor and the distant metastasis with surgery, radiation therapy, or both. However, these treatments aren’t suggested if there is N2 or N3 disease.
Part 6.4 covers stage IV cancers that can’t be treated with surgery or radiation therapy. This includes lung cancer that has spread to more than one site beyond the chest. In these cases, treatment depends on the molecular testing results and histologic subtype. Thus, treatment options are presented by three groups: cancers with overactive EGFR mutations, cancers with ALK gene rearrangements, and cancers with unknown or normal EGFR or ALK status. The last group is further divided by type of non-small cell lung cancer.

Chemotherapy is often used for stage IV disease. It can cause severe side effects. As such, it is only given if your health hasn’t seriously limited your activities. The ECOG (Eastern Cooperative Oncology Group) Performance Scale is used by doctors to decide who can have chemotherapy. The definition of each performance score is:

- A score of 0 means you are fully active.
- A score of 1 means you are able to do all self-care activities but are unable to do hard physical work.
- A score of 2 means you are able to do all self-care activities and spend most of waking time out of bed but are unable to do any work.
- A score of 3 means you are unable to do all self-care activities and any work and spend most of waking time in bed.
- A score of 4 means you are fully disabled.

Talk with your doctor about chemotherapy. Discuss which drugs will have greatest chance of treating the cancer. As well, talk about side effects. Let your doctor know which side effects you are willing to have.

Chart 6.4.1 lists the first-line treatments for lung cancers with EGFR mutations. First-line treatment isn’t based on performance status. Instead, any cancer with an overactive EGFR mutation should be treated with erlotinib or afatinib. Gefitinib may be used in place of erlotinib. These drugs are targeted therapies.

EGFR mutations may be found while you are on first-line chemotherapy. In this case, you may start targeted therapy after stopping chemotherapy early or after completing it. Another option is that you may take erlotinib while on first-line chemotherapy.

Chart 6.4.2 lists treatment options for cancer that keeps growing while on targeted therapy. Treatment options are based on whether the cancer is causing symptoms. If the cancer isn’t causing symptoms, keep taking the targeted therapy.

If the cancer is causing symptoms, treatment options are also based on where the cancer is in the body and the number of tumors. Local treatment may be given if only one new tumor has grown. You should also keep taking the targeted therapy.

If there are multiple tumors in your brain, consider having WBRT and stay on targeted therapy. Two or more new tumors, except if in the brain, should be treated according to the histologic type. Read pages 82–83 to learn options for Adenocarcinomas, large cell, and unknown types. Read pages 84–85 to learn options for Squamous cell carcinomas.
ALK gene rearrangement

**Chart 6.4.3 First-line treatment**

<table>
<thead>
<tr>
<th>Performance status</th>
<th>Treatment options</th>
</tr>
</thead>
<tbody>
<tr>
<td>Any</td>
<td>• Crizotinib</td>
</tr>
</tbody>
</table>

**Chart 6.4.4 Second-line treatment**

<table>
<thead>
<tr>
<th>Symptoms</th>
<th>Tumor location</th>
<th>Number of tumors</th>
<th>Treatment options</th>
</tr>
</thead>
<tbody>
<tr>
<td>No</td>
<td>Anywhere</td>
<td>Any</td>
<td>• Stay on crizotinib or switch to ceritinib</td>
</tr>
<tr>
<td>Yes</td>
<td>Brain</td>
<td>1</td>
<td>• Consider local treatment and stay on targeted therapy</td>
</tr>
<tr>
<td></td>
<td></td>
<td>2 or more</td>
<td>• Consider WBRT and stay on targeted therapy</td>
</tr>
<tr>
<td>Yes</td>
<td>Anywhere except brain</td>
<td>1</td>
<td>• Consider local treatment and stay on targeted therapy</td>
</tr>
<tr>
<td></td>
<td></td>
<td>2 or more</td>
<td>• Start ceritinib&lt;br&gt;• Start treatment for histologic type&lt;br&gt;  ◦ Adenocarcinomas, Large cell, Unknown&lt;br&gt;  ◦ Squamous cell carcinomas</td>
</tr>
</tbody>
</table>

**Chart 6.4.3** lists the first-line treatments for lung cancers with ALK mutations. First-line treatment isn’t based on performance status. Instead, any cancer with an ALK gene rearrangement should be first treated with crizotinib.

The ALK mutation may be found while you are on first-line chemotherapy. In this case, you may start crizotinib after stopping chemotherapy early. Otherwise, you may start after completing chemotherapy.

**Chart 6.4.4** lists treatment options for cancer that keeps growing while on crizotinib. Treatment options are based on whether the cancer is causing symptoms. If the cancer isn’t causing symptoms, keep taking crizotinib or switch to ceritinib.

If the cancer is causing symptoms, treatment options are also based on where the cancer is in the body and the number of tumors. You may start taking ceritinib instead of crizotinib. Local treatment may be given if only one new tumor has grown. You should also keep taking targeted therapy.
If there are multiple tumors in your brain, consider having WBRT and stay on crizotinib. Two or more new tumors, except if in the brain, may be treated with ceritinib or according to the histologic type. Read pages 82–83 to learn options for Adenocarcinomas, large cell, and unknown types. Read pages 84–85 to learn options for Squamous cell carcinomas.
Normal EGFR and ALK or unknown
Adenocarcinoma, large cell, unknown types

**Chart 6.4.5 First-line treatment**

<table>
<thead>
<tr>
<th>Performance status</th>
<th>Treatment options</th>
</tr>
</thead>
</table>
| 0 or 1             | • Doublet chemotherapy  
                      | • Bevacizumab + chemotherapy |
| 2                  | • Chemotherapy     |
| 3 or 4             | • Supportive care  |

**Chart 6.4.6 Maintenance treatment**

<table>
<thead>
<tr>
<th>Maintenance type</th>
<th>Treatment options</th>
</tr>
</thead>
</table>
| Continuation     | • Bevacizumab  
                      | • Pemetrexed  
                      | • Bevacizumab + pemetrexed  
                      | • Gemcitabine   |
| Switch           | • Erlotinib  
                      | • Pemetrexed  |
| –                | • Observation   |

**Chart 6.4.7 Second-line treatment**

<table>
<thead>
<tr>
<th>Performance status</th>
<th>Treatment options</th>
</tr>
</thead>
</table>
| 0, 1, or 2         | • Docetaxel  
                      | • Pemetrexed  
                      | • Erlotinib  
                      | • Gemcitabine  
                      | • Ramucirumab + docetaxel  
                      | • Nivolumab   |
| 3 or 4             | • Erlotinib  
                      | • Supportive care  |
Chart 6.4.5 lists treatments for adenocarcinomas, large cell carcinomas, and unknown types. These treatments may be used as first-line care for lung cancers without EGFR or ALK mutations. They also may be used as second-line treatment for some widespread lung cancers with EGFR or ALK mutations.

Treatment is based on performance status. You may be treated with chemotherapy if your performance score is between 0 and 2. Your doctor will choose a regimen based on how well it will stop cancer growth compared to how harmful it could be.

A performance score of 3 or 4 suggests that chemotherapy will be too harmful. Therefore, the best supportive care is recommended. Supportive care aims to treat the symptoms caused by the cancer.

The use of two drugs is called doublet chemotherapy. It is an option if your performance score is 0 or 1. Another option is bevacizumab used with chemotherapy. To receive this treatment, you should not have a recent history of coughing up blood (hemoptysis).

After 1 or 2 cycles of chemotherapy, the cancer’s response to treatment will be tested. It will be tested again every 2 to 4 cycles. If there’s no cancer growth, a total of 4 to 6 chemotherapy cycles are recommended.

Chart 6.4.6 lists treatment options for cancer that doesn’t grow during chemotherapy. You may stay on some of your first-line treatments. This is called continuation maintenance. Another option is changing to a drug that you didn’t take as a first-line treatment. This is called switch maintenance. A third option is to start close observation. Observation is a period of testing to watch for cancer growth.

Chart 6.4.7 lists treatment for cancers that grow during or after first-line treatment. Treatment is based on performance status. You may have chemotherapy if your performance scale is 0, 1, or 2. It is preferred over other options. Do not take the chemotherapy drugs listed if you’ve had them before.

Proteomic testing can assess for patterns of proteins related to lung cancer. This test may be done if the EFGR status is normal or unknown. Results are used to decide if erlotinib might help treat the cancer. Gefitinib may be used in place of erlotinib.

If your performance score is 3 or 4, most drugs for lung cancer are likely to seriously harm your health. Thus, best supportive care is recommended. Erlotinib can only be taken if the EGFR mutation is present.

Joining a clinical trial is always an option for lung cancer treatment. Ask your treatment team if there is a clinical trial you can join. Also ask about the pros and cons of the trial.
### Chart 6.4.8 First-line treatment

<table>
<thead>
<tr>
<th>Performance status</th>
<th>Treatment options</th>
</tr>
</thead>
<tbody>
<tr>
<td>0 or 1</td>
<td>• Doublet chemotherapy</td>
</tr>
<tr>
<td>2</td>
<td>• Chemotherapy</td>
</tr>
<tr>
<td>3 or 4</td>
<td>• Supportive care</td>
</tr>
</tbody>
</table>

### Chart 6.4.9 Maintenance treatment

<table>
<thead>
<tr>
<th>Maintenance type</th>
<th>Treatment options</th>
</tr>
</thead>
<tbody>
<tr>
<td>Continuation</td>
<td>• Gemcitabine</td>
</tr>
<tr>
<td>Switch</td>
<td>• Erlotinib</td>
</tr>
<tr>
<td></td>
<td>• Docetaxel</td>
</tr>
<tr>
<td>–</td>
<td>• Observation</td>
</tr>
</tbody>
</table>

### Chart 6.4.10 Second-line treatment

<table>
<thead>
<tr>
<th>Performance status</th>
<th>Treatment options</th>
</tr>
</thead>
<tbody>
<tr>
<td>0, 1, or 2</td>
<td>• Nivolumab</td>
</tr>
<tr>
<td></td>
<td>• Docetaxel</td>
</tr>
<tr>
<td></td>
<td>• Erlotinib</td>
</tr>
<tr>
<td></td>
<td>• Gemcitabine</td>
</tr>
<tr>
<td></td>
<td>• Ramucirumab + docetaxel</td>
</tr>
<tr>
<td>3 or 4</td>
<td>• Erlotinib</td>
</tr>
<tr>
<td></td>
<td>• Supportive care</td>
</tr>
</tbody>
</table>
Chart 6.4.8 lists treatments for squamous cell carcinomas. These treatments may be used as first-line care for lung cancers without EGFR or ALK mutations. They also may be used as second-line treatment for some widespread lung cancers with EGFR or ALK mutations. Consider having tests for other mutations if only EGFR and ALK testing was done.

Treatment is based on performance status. You may be treated with chemotherapy if your performance score is between 0 and 2. The use of two drugs is called doublet chemotherapy. It is an option if your performance score is 0 or 1. Your doctor will choose a regimen based on how well it will stop cancer growth compared to how harmful it could be.

After 1 or 2 cycles of chemotherapy, the cancer’s response to treatment will be tested. It will be tested again every 2 to 4 cycles. If there’s no cancer growth, a total of 4 to 6 chemotherapy cycles are recommended.

A performance score of 3 or 4 suggests that chemotherapy will be too harmful. Therefore, the best supportive care is recommended. Supportive care aims to treat the symptoms caused by the cancer.

Chart 6.4.9 lists treatment options for cancer that doesn’t grow during chemotherapy. You may stay on some of your first-line treatments. This is called continuation maintenance. Another option is changing to a drug that you didn’t take as a first-line treatment. This is called switch maintenance. A third option is to start close observation. Observation is a period of testing to watch for cancer growth.

Chart 6.4.10 lists treatment for cancers that grow during or after first-line treatment. Treatment is based on performance status. You may have chemotherapy if your performance scale is 0, 1, or 2. It is preferred over other options. Do not take the chemotherapy drugs listed if you’ve had them before.

Proteomic testing can assess for patterns of proteins related to lung cancer. This test may be done if the EGFR status is normal or unknown. Results are used to decide if erlotinib might help treat the cancer. Gefitinib may be used in place of erlotinib.

If your performance score is 3 or 4, most drugs for lung cancer are likely to seriously harm your health. Thus, best supportive care is recommended. Erlotinib can only be taken if the EGFR mutation is present.

Joining a clinical trial is always an option for lung cancer treatment. Ask your treatment team if there is a clinical trial you can join. Also ask about the pros and cons of the trial.
Review

- To try to cure stage I lung cancers, surgery or radiation therapy is given. If these treatments are not a cure, more treatment can be received. Once treatment is done, follow a survivorship care plan.

- Stage II tumors without invasion may be cured with surgery. More treatment is often given after surgery. If surgery isn’t an option, radiation therapy to cure is used for N0 disease, and chemoradiation for N1 disease. Once treatment is done, follow a survivorship care plan.

- Stage II tumors with invasion may be cured with surgery. You may receive chemotherapy or chemoradiation beforehand and more treatment afterward. If surgery isn’t an option, chemoradiation is used to cure. Once treatment is done, follow a survivorship care plan.

- For stage III tumors without invasion, N0 or N1 disease may be cured with surgery or chemoradiation. Surgery is less often used for N2 and N3 disease that was found before treatment was started. Chemotherapy, radiation therapy, or both is given after surgery. Once treatment is done, follow a survivorship care plan.

- For stage III tumors with invasion may be cured with surgery or chemoradiation. You may receive chemotherapy or chemoradiation before surgery. More treatment is often given afterward. Once treatment is done, follow a survivorship care plan.

- For stage IV cancers, supportive care may enhance and extend life. Ask your treatment team for a supportive care plan.

- Widespread metastatic disease with overactive EGFR mutations is first treated with erlotinib or afatinib. For ALK rearrangements, start with crizotinib and switch to ceritinib if needed.

- If you are healthy enough, widespread metastatic disease with no known mutations is treated with chemotherapy. Targeted therapy may be added. If you are unhealthy, supportive care is an option. Clinical trials are an option for all metastatic disease.
Treatment guide: Multiple primary tumors
7 Treatment guide: Multiple primary tumors

7.1 Without symptoms

Presents options for cancer that isn’t causing symptoms.

7.2 With symptoms

Presents options for cancer that is causing symptoms.

Review
Part 7 is a guide to the treatment options for people with multiple primary non-small cell lung tumors. This information is taken from the treatment guidelines written by NCCN experts for lung cancer doctors. The aim is to cure or control the cancer. Receiving supportive care is also important. Your doctors may suggest other treatments than those listed in Part 7 based on your health and personal wishes.

Based on biopsy results or prior lung cancer, your doctors may think you have more than one primary tumor. Multiple primary tumors may occur at the same time. Or you may have been treated for one primary tumor and now have a second primary tumor. Multiple primary tumors may be the same or a different histologic subtype of lung cancer.

Treatment options depend on if the cancer has spread beyond the chest. If so, read Part 6.4. These cancers are treated the same as metastatic disease. Likewise, read Part 6.4 if there’s N2 or N3 disease confined to the chest. For N0 or N1 disease, read Part 7 to learn about treatment options.
### 7.1 Without symptoms

#### Chart 7.1.1 Initial treatment for co-occurring tumors

<table>
<thead>
<tr>
<th>Symptom onset</th>
<th>Treatment status</th>
<th>Treatment options</th>
</tr>
</thead>
<tbody>
<tr>
<td>Symptoms won’t likely start soon</td>
<td>–</td>
<td>• Start survivorship care plan</td>
</tr>
</tbody>
</table>
| Symptoms likely to start soon   | Local treatments may cure | • Surgery (preferred)  
                              |                                                      | • Radiation therapy  
                              |                                                      | • Ablation                         |
|                                | Local treatments won’t cure | • Consider chemotherapy with or without local treatments to prevent symptoms |

#### Chart 7.1.2 Initial treatment for back-to-back tumors

<table>
<thead>
<tr>
<th>Treatment status</th>
<th>Treatment options</th>
</tr>
</thead>
</table>
| Local treatments may cure | • Surgery (preferred)  
                          | • Radiation therapy  
                          | • Ablation                         |
| Local treatments won’t cure | • Consider chemotherapy with or without local treatments to prevent symptoms |

#### Chart 7.1.3 Survivorship care plan

<table>
<thead>
<tr>
<th>Type of care</th>
<th>Schedule of care</th>
</tr>
</thead>
</table>
| Medical history and physical exam      | • Every 6–12 months for 2 years  
                          | ◦ If normal results, then repeat every year                          |
| Chest CT ± contrast                    | • Every 6–12 months for 2 years  
                          | ◦ If normal results, then LDCT without contrast every year           |
| General health tests (eg, bone density) | • As needed                                                            |
| Prevent other diseases (eg, cancer screening) | • As needed                                                            |
| Healthy lifestyle (eg, healthy diet, no smoking) | • As needed                                                            |
Chart 7.1.1 lists treatment options for multiple tumors that appeared at the same time. Cancers that won’t likely cause symptoms soon don’t need treatment at this time. These tumors are either slow growing or are in a place that won’t cause severe symptoms.

If symptoms are likely, the cancer should be treated. If local treatments can be received, surgery that spares as much of the lung as possible is preferred. Otherwise, radiation therapy or ablation is an option. If local treatment isn’t possible, chemotherapy or local treatments for symptom relief may be given. Read Part 6.4 to learn options for chemotherapy.

Chart 7.1.2 lists treatment options for multiple tumors that appeared one after the other. If local treatments can be received, surgery that spares as much as the lung as possible is preferred. Otherwise, radiation therapy or ablation is suggested. If local treatment isn’t possible, chemotherapy or local treatments for symptom relief may be given. Read Part 6.4 to learn options for chemotherapy.

Chart 7.1.3 lists recommendations for your survivorship care plan. These plans start when treatment is done and tests show no signs of cancer. The plan should address your whole health and well-being. Talk with your doctor about making a plan together.

Follow-up cancer tests are given to find any new lung tumors early. A medical history, physical exam, and chest CT scan with or without contrast are recommended every 6 to 12 months for 2 years. If results are normal, it is suggested that you have these tests once a year. The yearly scan should be an LDCT given without contrast.

Besides follow-up tests, tests of your general health are recommended. After going through treatment for cancer, it may be hard to think about taking care of “less important” issues. However, your general health can have a big impact on your well-being. Have your blood pressure, cholesterol, and glucose checked on a regular basis. Some people also need bone density testing.

Likewise, take steps to prevent other diseases. Such steps can include getting immunization shots for the flu, herpes, and other diseases. Dental cleaning and exams on a regular basis can prevent disease, too. Screening tests for other cancers is also very important.

The last recommendation is to start or keep a healthy lifestyle. There is proof that healthy behaviors can improve your treatment results. Limiting your use of alcohol, protecting yourself from the sun, and being at a healthy weight are important.

Healthy eating includes eating a balanced diet, eating the right amount of food, and drinking enough fluids. However, you may have special food needs during and after treatment. A nutritionist—an expert in creating a healthy diet—can help.

Many patients benefit from some exercise. Exercise tones muscles, lowers stress, and improves health. Exercise programs differ between people based on their needs. Talk with your treatment team about which exercises would be best for you.

Being hooked on nicotine is one of the hardest addictions to stop. The stress of lung cancer may make it harder or easier to quit. Quitting is important since smoking can limit how well cancer treatment works. Talk with your treatment team about ways to quit.
### Chart 7.2.1 Initial treatment

<table>
<thead>
<tr>
<th>Treatment status</th>
<th>Treatment options</th>
</tr>
</thead>
<tbody>
<tr>
<td>Local treatments may cure</td>
<td>• Surgery (preferred)</td>
</tr>
<tr>
<td></td>
<td>• Radiation therapy</td>
</tr>
<tr>
<td></td>
<td>• Ablation</td>
</tr>
<tr>
<td>Local treatments won’t cure</td>
<td>• Consider chemotherapy with or without local treatments to relieve symptoms</td>
</tr>
</tbody>
</table>

### Chart 7.2.2 Survivorship care plan

<table>
<thead>
<tr>
<th>Type of care</th>
<th>Schedule of care</th>
</tr>
</thead>
<tbody>
<tr>
<td>Medical history and physical exam</td>
<td>• Every 6–12 months for 2 years</td>
</tr>
<tr>
<td></td>
<td>• If normal results, then repeat every year</td>
</tr>
<tr>
<td>Chest CT ± contrast</td>
<td>• Every 6–12 months for 2 years</td>
</tr>
<tr>
<td></td>
<td>• If normal results, then LDCT without contrast every year</td>
</tr>
<tr>
<td>General health tests (eg, bone density)</td>
<td>• As needed</td>
</tr>
<tr>
<td>Prevent other diseases (eg, cancer screening)</td>
<td>• As needed</td>
</tr>
<tr>
<td>Healthy lifestyle (eg, healthy diet, no smoking)</td>
<td>• As needed</td>
</tr>
</tbody>
</table>
Chart 7.2.1 lists treatment options for multiple tumors that are causing symptoms. Cancer symptoms are a sign of advanced cancer growth, so treatment is an option. If local treatments can be received, surgery that spares as much of the lung as possible is preferred. Otherwise, radiation therapy or ablation is recommended. If local treatment isn’t possible, chemotherapy or local treatments for symptom relief may be given. Read Part 6.4 to learn options for chemotherapy.

Chart 7.2.2 lists recommendations for your survivorship care plan. These plans start when treatment is done and tests show no signs of cancer. The plan should address your whole health and well-being. Talk with your doctor about making a plan together.

Follow-up cancer tests are given to find any new lung tumors early. A medical history, physical exam, and chest CT scan with or without contrast are recommended every 6 to 12 months for 2 years. If results are normal, it is suggested that you have these tests once a year. The yearly scan should be a LDCT given without contrast.

Besides follow-up tests, tests of your general health are recommended. After going through treatment for cancer, it may be hard to think about taking care of “less important” issues. However, your general health can have a big impact on your well-being. Have your blood pressure, cholesterol, and glucose checked on a regular basis. Some people also need bone density testing.

Likewise, take steps to prevent other diseases. Such steps can include getting immunization shots for the flu, herpes, and other diseases. Dental cleaning and exams on a regular basis can prevent disease, too. Screening tests for other cancers is also very important.

The last recommendation is to start or keep a healthy lifestyle. There is proof that healthy behaviors can improve your treatment results. Limiting your use of alcohol, protecting yourself from the sun, and being at a healthy weight are important.

Healthy eating includes eating a balanced diet, eating the right amount of food, and drinking enough fluids. However, you may have special food needs during and after treatment. A nutritionist—an expert in creating a healthy diet—can help.

Many patients benefit from some exercise. Exercise tones muscles, lowers stress, and improves health. Exercise programs differ between people based on their needs. Talk with your treatment team about which exercises would be best for you.

Being hooked on nicotine is one of the hardest addictions to stop. The stress of lung cancer may make it harder or easier to quit. Quitting is important since smoking can limit how well cancer treatment works. Talk with your treatment team about ways to quit.
Review

- Multiple primary tumors that have spread to N2 or N3 nodes or spread outside the chest area are treated the same as metastatic disease. Multiple primary tumors with N0 or N1 disease are treated based on traits of the cancer.

- If it is unlikely that cancer symptoms will appear, multiple primary tumors that appear at the same time don’t need treatment now.

- Signs that treatment is needed include current or soon-to-start symptoms and primary tumors that appear one after the other. In these cases, local treatments are an option if the cancer may be cured. Otherwise, chemotherapy with or without local treatments may be received.
Making treatment decisions
Having cancer is very stressful. While absorbing the fact that you have cancer, you have to learn about tests and treatments. In addition, the time you have to accept a treatment plan feels short. Parts 1 through 7 described the cancer and the test and treatment options recommended by NCCN experts. These options are based on science and agreement among NCCN experts. Part 8 aims to help you make decisions that are in line with your beliefs, wishes, and values.
It’s your choice

The role patients want in choosing their treatment differs. You may feel uneasy about making treatment decisions. This may be due to a high level of stress. It may be hard to hear or know what others are saying. Stress, pain, and drugs can limit your ability to make good decisions. You may feel uneasy because you don’t know much about cancer. You’ve never heard the words used to describe cancer, tests, or treatments. Likewise, you may think that your judgement isn’t any better than your doctors’.

Your doctors will give you the information you need to make an informed choice. In early-stage disease, there are often multiple good options. It is good news to have multiple options.

Letting others decide which option is best may make you feel more at ease. But, whom do you want to make the decisions?

You may rely on your doctors alone to make the right decisions. However, your doctors may not tell you which treatment to choose if you have multiple good options. You can also have loved ones help. They can gather information, speak on your behalf, and share in decision-making with your doctors. Even if others decide which treatment you will receive, you still have to agree by signing a consent form.

On the other hand, you may want to take the lead or share in decision-making. Most patients do. In shared decision-making, you and your doctors share information, weigh the options, and agree on a treatment plan.

Your doctors know the science behind your plan but you know your concerns and goals. By working together, you are likely to get a higher quality of care and be more satisfied. You’ll likely get the treatment you want, at the place you want, and by the doctors you want.
Questions to ask your doctors

You will likely meet with experts from different fields of medicine. Strive to have helpful talks with each person. Prepare questions before your visit and ask questions if the person isn’t clear. You can also record your talks and get copies of your medical records. It may be helpful to have your spouse, partner, or a friend with you at these visits. They can help to ask questions and remember what was said. Suggested questions to ask include:

What's my diagnosis and prognosis?

It's important to know that there are different types of cancer. Cancer can greatly differ even when people have a tumor in the same organ. Based on your test results, your doctors can tell you which type of cancer you have. He or she can also give a prognosis. A prognosis is a prediction of the pattern and outcome of a disease. Knowing the prognosis may affect what you decide about treatment.

1. Where did the cancer start? In what type of cell?
2. Is this cancer common?
3. What is the cancer stage? Does this stage mean the cancer has spread far?
4. What is the grade of the cancer? Does this grade mean the cancer will grow and spread fast?
5. What other test results are important to know?
6. How often are these tests wrong?
7. Would you give me a copy of the pathology report and other test results?
8. Can the cancer be cured? If not, how well can treatment stop the cancer from growing?
What are my options?

There is no single treatment practice that is best for all patients. There is often more than one treatment option along with clinical trial options. Your doctor will review your test results and recommend treatment options.

1. What will happen if I do nothing?
2. Can I just carefully monitor the cancer?
3. Do you consult NCCN recommendations when considering options?
4. Are you suggesting options other than what NCCN recommends? If yes, why?
5. How do my age, health, and other factors affect my options?
6. Which option is proven to work best?
7. Which options lack scientific proof?
8. What are the benefits of each option? Does any option offer a cure? Are my chances any better for one option than another? Which option spares the most healthy tissue? Is any option less invasive? Less time-consuming? Less expensive?
9. What are the risks of each option? What are possible complications? What are the rare and common side effects? Short-lived and long-lasting side effects? Serious or mild side effects? Other risks?
What does each option require of me?

Many patients consider how each option will practically affect their lives. This information may be important because you have family, jobs, and other duties to take care of. You also may be concerned about getting the help you need. If you have more than one option, choosing the option that is the least taxing may be important to you:

1. Will I have to go to the hospital or elsewhere? How often? How long is each visit?
2. How do I prepare for treatment?
3. Should I bring someone with me when I get treated?
4. Will the treatment hurt?
5. How much will the treatment cost me? What does my insurance cover?
6. Is home care after treatment needed? If yes, what type?
7. How soon will I be able to manage my own health?
8. When will I be able to return to my normal activities?
What is your experience?

More and more research is finding that patients treated by more experienced doctors have better results. It is important to learn if a doctor is an expert in the cancer treatment he or she is offering.

1. Are you board certified? If yes, in what area?
2. How many patients like me have you treated?
3. How many procedures like the one you’re suggesting have you done?
4. Is this treatment a major part of your practice?
5. How many of your patients have had complications?
Weighing your options

Deciding which option is best can be hard. Doctors from different fields of medicine may have different opinions on which option is best for you. This can be very confusing. Your spouse or partner may disagree with which option you want. This can be stressful. In some cases, one option hasn’t been shown to work better than another, so science isn’t helpful. Some ways to decide on treatment are discussed next.

2nd opinion
The time around a cancer diagnosis is very stressful. People with cancer often want to get treated as soon as possible. They want to make their cancer go away before it spreads farther. While cancer can’t be ignored, there is time to think about and choose which option is best for you.

You may wish to have another doctor review your test results and suggest a treatment plan. This is called getting a 2nd opinion. You may completely trust your doctor, but a 2nd opinion on which option is best can help.

Copies of the pathology report, a DVD of the imaging tests, and other test results need to be sent to the doctor giving the 2nd opinion. Some people feel uneasy asking for copies from their doctors. However, a 2nd opinion is a normal part of cancer care.

When doctors have cancer, most will talk with more than one doctor before choosing their treatment. What’s more, some health plans require a 2nd opinion. If your health plan doesn’t cover the cost of a 2nd opinion, you have the choice of paying for it yourself.

If the two opinions are the same, you may feel more at peace about the treatment you choose to have. If the two opinions differ, think about getting a 3rd opinion. A 3rd opinion may help you decide between your options. Choosing your cancer treatment is a very important decision. It can affect your length and quality of life.

Support groups
Besides talking to health experts, it may help to talk to patients who have walked in your shoes. Support groups often consist of people at different stages of treatment. Some may be in the process of deciding while others may be finished with treatment. At support groups, you can ask questions and hear about the experiences of other people with lung cancer.

Compare benefits and downsides
Every option has benefits and downsides. Consider these when deciding which option is best for you. Talking to others can help identify benefits and downsides you haven’t thought of. Scoring each factor from 0 to 10 can also help since some factors may be more important to you than others.
My notes
Websites

American Cancer Society  
www.cancer.org/cancer/lungcancer-non-smallcell/index

Lung Cancer Alliance  
www.lungcanceralliance.org/

Lung Cancer Research Council  
www.lungcancerresearchcouncil.org/

National Cancer Institute  
www.cancer.gov/types/lung

National Coalition for Cancer Survivorship  
www.canceradvocacy.org/toolbox

NCCN  
www.nccn.org/patients

Review

• Shared decision-making is a process in which you and your doctors plan treatment together.

• Asking your doctors questions is vital to getting the information you need to make informed decisions.

• Getting a 2\textsuperscript{nd} opinion, attending support groups, and comparing benefits and downsides may help you decide which treatment is best for you.
Glossary
| **ablation** | Treatment that destroys very small tumors. |
| **adenocarcinoma** | Cancer of cells that make fluids or hormones. |
| **adrenal gland** | A small organ on top of each kidney that makes hormones. |
| **alveoli** | The tiny sacs in the lungs where gases are transferred in and out of the blood. |
| **anaplastic lymphoma kinase (ALK)** | Proteins on the edge of a cell that send signals for the cell to grow. |
| **anesthesia** | Loss of feeling with or without loss of wakefulness that is caused by drugs. |
| **atelectasis** | Collapse of a lung. |
| **biopsy** | Removal of small amounts of tissue or fluid to be tested for disease. |
| **blood chemistry test** | Measurement of the amount of chemicals in the blood. |
| **board certified** | A status to identify doctors who finished training in a specialized field of medicine. |
| **body plethysmograph** | A test done in a small room with a small tube to measure how much air is in your lungs after inhaling or exhaling. |
| **brachytherapy** | Radiation received from a radioactive object placed near or in the tumor. |
| **bronchi** | The two airways extending from the windpipe into the lungs. |
| **bronchioli** | Branches of small airways within the lungs. |
| **bronchoscope** | A thin, long tube fitted with tools that is guided down the mouth. |
| **bronchoscopy** | Use of a thin tool guided down the mouth into the lungs. |
| **bronchus** | One of the two main airways that extends into the lungs. |
| **cancer screening** | The use of tests to find cancer before signs of cancer appear. |
| **cancer stage** | A rating of the growth and spread of tumors. |
| **carcinoma** | Cancer of cells that form the lining of structures or form glands. |
| **carina** | Firm, flexible, supportive tissue at the base of the windpipe. |
| **chemoradiation** | Treatment that combines chemotherapy with radiation therapy. |
| **chemotherapy** | Drugs that stop the growth process of cells in an active growth phase. |
| **chest wall** | The layer of muscles and bones under the skin that covers the chest area. |
| **chronic obstructive pulmonary disease (COPD)** | Trouble with breathing due to lung damage or too much mucus. |
| **clinical stage** | Rating the extent of a tumor based on tests before treatment. |
| **clinical trial** | Research on a test or treatment to assess its safety or how well it works. |
combination regimen
The use of two or more drugs.

complete blood count (CBC)
A test of the number of blood cells.

computed tomography (CT)
A test that uses x-rays to view body parts.

continuation maintenance
One or more first-line drugs is continued.

contrast
A dye put into your body to make clearer pictures during imaging tests.

conventional radiation therapy
Radiation that is given in small doses for weeks and targets both the tumor and some normal tissue.

diagnosis
To identify a disease.

diaphragm
A sheet of muscles below the ribs that helps a person to breathe.

doublet chemotherapy
Treatment with two chemotherapy drugs.

Eastern Cooperative Oncology Group (ECOG) performance scale
A rating scale of one's ability to do daily activities.

endobronchial ultrasound–guided transbronchial needle aspiration (EBUS-TBNA)
Removal of fluid with a needle guided with imaging into the main airway into the lung.

endoscopic ultrasound–guided fine needle aspiration (EUS-FNA)
Removal of fluid with a needle guided with imaging into the long organ between the mouth and stomach.

epidermal growth factor receptor (EGFR)
Proteins on the edge of a cell that send signals for the cell to grow.

esophagus
The tube-shaped organ between the mouth and stomach.

excision
Removal of a tumor but not too much healthy tissue.

external beam radiation therapy (EBRT)
Radiation therapy received from a machine outside the body.

fine-needle aspiration (FNA)
Use of a thin needle to remove fluid or tissue from the body to test for disease.

four-dimensional computed tomography (4D-CT)
An imaging test that can show movement of organs.

gas diffusion
A test that uses harmless gas to measure how much you breathe out.

gene
Instructions in cells for making and controlling cells.

gene rearrangement
The fusion of one gene with another gene to create a new gene.

general anesthesia
A controlled loss of wakefulness from drugs.

hadron therapy
Radiation therapy that uses protons to treat a disease.

hilar nodes
Groups of disease-fighting cells where the main airways enter the lungs.

image-guided radiation therapy (IGRT)
Radiation therapy that uses imaging tests during treatment to better target the tumor.

immunotherapy
Treatment that uses the body’s natural defense against disease.

intensity-modulated radiation therapy (IMRT)
Radiation therapy that uses small beams of different strengths based on the thickness of the tissue.

intrapulmonary nodes
Groups of disease-fighting cells in the lungs around the small airways.

invasion
A mass of cancer cells that has grown from one structure into another.

large-cell lung carcinoma
A lack of features to classify the cancer as any other carcinoma.
lobectomy  
Surgical removal of an entire lobe.

local anesthesia  
A loss of feeling in a small area of the body caused by drugs.

low-dose computed tomography (LDCT)  
A test that uses little amounts of radiation to make pictures of inside the body.

lymph  
A clear fluid containing white blood cells.

lymph node  
Small groups of special disease-fighting cells located throughout the body.

lymph node dissection  
All groups of disease-fighting cells are removed from a cluster.

lymph node sampling  
One group of disease-fighting cells is removed from a cluster.

lymph vessels  
Tube-shaped ducts that carry lymph throughout the body.

magnetic resonance imaging (MRI)  
A test that uses radio waves and powerful magnets to see the shape and function of body parts.

maintenance treatment  
Treatment given to continue good treatment results.

mediastinal nodes  
Groups of disease-fighting cells in the middle of the chest.

mediastinal pleura  
The lining of the lung at the center of the chest.

mediastinoscope  
A thin, long tube fitted with tools to work inside the chest.

mediastinoscopy  
Use of a thin tool inserted above the breastbone to do work in the middle of the chest.

mediastinum  
The area of the chest between the lungs.

medical history  
All health events and medications taken to date.

metastasis  
The spread of cancer cells from the first tumor to another body part.

molecular testing  
Tests of changes in the instructions within cells for making and controlling cells (genes).

multiple primary tumors  
One or more unrelated masses of cancer cells.

mutation  
Abnormal changes in the instructions within cells for making and controlling cells (genes).

navigational bronchoscopy  
Use of a thin tool guided down the mouth into the smallest airways of the lung.

nodule  
A small mass of tissue.

non-small cell lung cancer  
A cancer that starts in lung cells that are not small.

non-solid nodule  
A small mass of tissue of low density.

observation  
A period of testing for cancer growth.

parietal pleura  
The outer layer of the lining around the lungs.

part-solid nodule  
A small mass of tissue with areas of low and high density.

pathologic stage  
Rating the extent of a tumor based on tests after treatment.

pathologist  
A doctor who’s an expert in testing cells to find disease.

percutaneous needle biopsy  
Insertion of a needle through the skin into a mass to remove tissue for testing.

performance status  
A rating of one’s ability to do daily activities.
**peribronchial nodes**  
Groups of disease-fighting cells in the lung around the main airway.

**pericardial effusion**  
Excess fluid between the two tissue layers of the heart’s lining.

**pericardiocentesis**  
Use of a needle inserted between the ribs to remove fluid around the heart.

**pericardium**  
The tissue lining around the heart.

**phrenic nerve**  
A bundle of fibers that sends signals between the spine and muscles used to breathe.

**physical exam**  
A review of the body by a health expert for signs of disease.

**platinum doublet**  
Treatment with two chemotherapy drugs, one of which is platinum-based.

**pleura**  
The tissue lining around the lungs.

**pleural cavity**  
The space between the two layers of the lung’s lining.

**pleural effusion**  
Excess fluid between the two tissue layers of the lung’s lining.

**pleural fluid**  
The liquid in the space between the two layers of the lung’s lining.

**pneumonectomy**  
Surgical removal of the entire lung.

**pneumonitis**  
Swelling of the air sacs in a lung.

**positron emission tomography (PET)**  
A test that uses radioactive material to see the shape and function of body parts.

**primary tumor**  
The first mass of cancer cells of their kind.

**prognosis**  
The expected pattern and outcome of a disease based on tests.

**proteomic testing**  
Tests that assess for patterns of proteins related to cancer.

**pulmonary fibrosis**  
Major scarring of lung tissue.

**pulmonary function tests**  
A set of breathing tests to test the strength of the lungs.

**pulmonologist**  
A doctor who’s an expert in lung diseases.

**radiation oncologist**  
A doctor who’s an expert in treating cancer with radiation.

**radiation therapy**  
The use of radiation to treat cancer.

**radiologist**  
A doctor who’s an expert in reading imaging tests.

**recurrent laryngeal nerve**  
A bundle of fibers that sends signals between the spine and voice box.

**respiratory system**  
The group of organs that transfers gases in and out of the body.

**risk factor**  
Something that increases the chance of getting a disease.

**scalene nodes**  
Groups of disease-fighting cells in the neck.

**secondary tumor**  
A mass of cancer cells that formed from the first mass of cancer cells.

**second-hand smoke**  
Inhaled smoke from a lit smoking product or that was exhaled by a smoker.

**sedative**  
A drug that helps a person to relax or go to sleep.

**segmentectomy**  
Surgical removal of a large part of a lobe.

**sequential chemoradiation**  
Chemotherapy followed by radiation therapy.
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<td><strong>visceral pleura</strong></td>
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<td><strong>wedge resection</strong></td>
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<td><strong>whole brain radiation therapy (WBRT)</strong></td>
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Acronyms

3D-CRT
three-dimensional conformal radiation therapy

4D-CT
four-dimensional computed tomography

AJCC
American Joint Committee on Cancer

ALK
anaplastic lymphoma kinase

CAM
complementary and alternative medicine

CBC
complete blood count

COPD
chronic obstructive pulmonary disease

CT
computed tomography

DNA
deoxyribonucleic acid

EBRT
external beam radiation therapy

EBUS
endobronchial ultrasound

EBUS-TBNA
endobronchial ultrasound-guided transbronchial needle aspiration

ECOG
Eastern Cooperative Oncology Group

EGFR
epidermal growth factor receptor

EUS
endoscopic ultrasound

EUS-FNA
endoscopic ultrasound-guided fine-needle aspiration

FNA
fine-needle aspiration

IGRT
image-guided radiation therapy

IMRT
intensity-modulated radiation therapy

LDCT
low-dose computed tomography

MRI
magnetic resonance imaging

PET
positron emission tomography

SABR
stereotactic ablative radiotherapy

SRS
stereotactic radiosurgery

TTNA
transthoracic needle aspiration

VATS
video-assisted thoracic surgery

VEGF
vascular endothelial growth factor

WBRT
whole brain radiation therapy

NCCN Abbreviations and Acronyms

NCCN
National Comprehensive Cancer Network®

NCCN Patient Guidelines
NCCN Guidelines for Patients®

NCCN Guidelines®
NCCN Clinical Practice Guidelines in Oncology®
State Fundraising Notices

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The following information will be sent upon request: (A) A full and fair description of the programs and activities of NCCN Foundation; and (B) A financial statement or summary which shall be consistent with the financial statement required to be filed with the Secretary of State pursuant to Code Section 43-17-5.

**KANSAS:** The annual financial report for NCCN Foundation, 275 Commerce Drive, Suite 300, Fort Washington, PA 19034, 215-690-0300, State Registration # 445-497-1, is filed with the Secretary of State.

**MARYLAND:** A copy of the NCCN Foundation financial report is available by calling NCCN Foundation at 215-690-0300 or writing to 275 Commerce Drive, Suite 300, Fort Washington, PA 19034. For the cost of copying and postage, documents and information filed under the Maryland charitable organizations law can be obtained from the Secretary of State, Charitable Division, State House, Annapolis, MD 21401, 1-410-974-5534.

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Stephen C. Yang, MD
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Omaha, Nebraska  
800.999.5465  
nebraskamed.com/cancer

Case Comprehensive Cancer Center/University Hospitals Seidman Cancer Center and Cleveland Clinic Taussig Cancer Institute  
Cleveland, Ohio  
800.641.2422 • UH Seidman Cancer Center uhospitals.org/seidman  
866.223.8100 • CC Taussig Cancer Institute my.clevelandclinic.org/services/cancer  
216.844.8797 • Case CCC case.edu/cancer

City of Hope Comprehensive Cancer Center  
Los Angeles, California  
800.826.4673  
cityofhope.org

Dana-Farber/Brigham and Women's Cancer Center/Massachusetts General Hospital Cancer Center  
Boston, Massachusetts  
877.332.4294  
dfbwcc.org  
massgeneral.org/cancer

Duke Cancer Institute  
Durham, North Carolina  
888.275.3853  
dukecancerinstitute.org

Fox Chase Cancer Center  
Philadelphia, Pennsylvania  
888.369.2427  
foxcchase.org

Huntsman Cancer Institute at the University of Utah  
Salt Lake City, Utah  
877.585.0303  
huntsmancancer.org

Fred Hutchinson Cancer Research Center/Seattle Cancer Care Alliance  
Seattle, Washington  
206.295.7222 • seattlecca.org  
206.667.5000 • fredhutch.org

The Sidney Kimmel Comprehensive Cancer Center at Johns Hopkins  
Baltimore, Maryland  
410.955.8964  
hopkinskimmelcancercenter.org

Robert H. Lurie Comprehensive Cancer Center of Northwestern University  
Chicago, Illinois  
866.587.4322  
cancer.northwestern.edu

Mayo Clinic Cancer Center  
Phoenix/Scottsdale, Arizona  
Jacksonville, Florida  
Rochester, Minnesota  
800.446.2279 • Arizona  
904.953.0853 • Florida  
507.538.3270 • Minnesota  
mayoclinic.org/departments-centers/mayo-clinic-cancer-center

Memorial Sloan Kettering Cancer Center  
New York, New York  
800.525.2225  
mskcc.org

Moffitt Cancer Center  
Tampa, Florida  
800.456.3434  
moffitt.org

The Ohio State University Comprehensive Cancer Center - James Cancer Hospital and Solove Research Institute  
Columbus, Ohio  
800.293.5066  
cancer.osu.edu

Roswell Park Cancer Institute  
Buffalo, New York  
877.275.7724  
roswellpark.org

Siteman Cancer Center at Barnes-Jewish Hospital and Washington University School of Medicine  
St. Louis, Missouri  
800.600.3606  
siteman.wustl.edu

St. Jude Children's Research Hospital/  
The University of Tennessee Health Science Center  
Memphis, Tennessee  
888.226.4343 • stjude.org  
901.683.0055 • westclinic.com

Stanford Cancer Institute  
Stanford, California  
877.668.7535  
cancer.stanford.edu

University of Alabama at Birmingham Comprehensive Cancer Center  
Birmingham, Alabama  
800.822.0933  
www.uab.edu

UC San Diego Moores Cancer Center  
La Jolla, California  
858.657.7000  
cancer.ucsd.edu

UCSF Helen Diller Family Comprehensive Cancer Center  
San Francisco, California  
800.689.8273  
cancer.ucsf.edu

University of Colorado Cancer Center  
Aurora, Colorado  
720.848.0300  
coloradocancercenter.org

University of Michigan Comprehensive Cancer Center  
Ann Arbor, Michigan  
800.865.1125  
mcancer.org

The University of Texas MD Anderson Cancer Center  
Houston, Texas  
800.392.1611  
mdanderson.org

Vanderbilt-Ingram Cancer Center  
Nashville, Tennessee  
800.811.8480  
vicc.org

Yale Cancer Center/Smilow Cancer Hospital  
New Haven, Connecticut  
855.4.SMILOW  
yalecancercenter.org
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