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We would like to acknowledge our patients, as well as their families, who appear in this guide. They graciously agreed to share their experiences with lung cancer in order to help educate and comfort others who are facing the same challenges, and for this we thank them.

— John R. Eckardt, MD

— Julia E. Kimmis, RN, BC, FNP-C, AOCN
Preface

Of the many questions that pulse through the mind of a patient newly diagnosed with lung cancer, perhaps the most prevailing one is “What is going to happen to me?” The diagnosis triggers fear and sometimes panic, and the assumption most often made is that life has been cut short. This feeling that one has lost control causes confusion, which can only be heightened by the volume of information available on the Internet and the well-intentioned though perhaps unreliable advice of family and friends.

Our goal in publishing this booklet is to “turn on the light,” so to speak. We want to provide you and your family with the most accurate information available and clear up any misconceptions you may have; in essence, we want the booklet to be a reliable source that you can refer to often.

Although it is not a comprehensive guide—that would require a voluminous text—the booklet does contain a cross-section of information pertinent to assisting you in partnering with your oncologist in making decisions about treatment and follow-up care. The various stages of lung cancer are explained, as are the tools a physician may use to reach a diagnosis and determine the extent of your disease. We explain the risk factors that may have contributed to the development of the disease and provide you with information about the standards of care and treatment options for each stage of lung cancer. We also include information to guide your search for clinical trials that you may be eligible to participate in.

In addition, we have included the case histories and personal anecdotes of several lung cancer patients; they describe their feelings, concerns, and ultimately, their experiences with treatment and invite you into the community of lung cancer patients with the reassurance that you are not alone. We thank these patients for their openness and willingness to help others affected by this disease.

We trust that this booklet is a comforting source of information for you and your family—small enough to be carried comfortably in your purse or briefcase but large enough to contain the information you need.
Chapter 1

Introduction

ALBERT Z.—My biggest fear was that I had cancer. Everyone in my family was scared and sad, but we pulled together. We had family meetings to talk about my diagnosis and to decide the best course of treatment.

When I was first diagnosed, I was still very mobile, able to work, and more independent. As time and treatment progressed, I was not able to do as much for myself and had to depend on my family more for help with day-to-day activities.

My doctor is a very strong and positive influence and support system. He keeps us informed and discusses all aspects of treatment with my family. He respects our wishes.

I would tell others in my situation to keep faith, to keep a positive outlook, and to go for the chemotherapy treatments. I did have some apprehension about the side effects from treatment, but I felt that as long as the treatments were working, the side effects were worth it.

—Albert Z.

Lung cancer is one of the most common cancers in the world. In the United States, approximately 215,020 new cases are diagnosed each year. While a diagnosis of lung cancer can be emotionally devastating, it is not necessarily a death sentence. Newer chemotherapy agents and novel ways of combining chemotherapy with radiation therapy and surgery offer patients greater hope for improved survival and better quality of life.

WHY DO PEOPLE DEVELOP LUNG CANCER?

Several risk factors can make you more likely to develop lung cancer. The number 1 risk factor for lung cancer is smoking.

Tobacco Smoking—At the beginning of the 20th century, lung cancer was rare. Then mass manufacturing techniques made cigarettes readily
Case History #1

Albert Z. was diagnosed with lung cancer. He had smoked 2½ packs a day for about 45 years, until he quit 2 years after his diagnosis. His history of lung cancer began when, at age 59, he had pneumonia; a chest x-ray revealed a questionable mass in the left lower lobe of his lung. A lobectomy confirmed that Mr. Z had poorly differentiated adenocarcinoma with chronic inflammation. One year after diagnosis, a small lesion under his tongue was shown to be squamous cell carcinoma. Four years after diagnosis, a chest x-ray revealed a small abnormality on the left lung. After developing a new lesion on the right lung, he underwent a right lobectomy that revealed poorly differentiated squamous cell cancer. This area was removed by surgery. A left lobectomy revealed squamous cell carcinoma, poorly differentiated, with invasion into the pleura.

Mr. Z. was being monitored for 5 years when a chest x-ray showed a new right upper lobe nodule. Following a PET scan showing recurrence and a CT scan showing doubling of the tumor size, Mr. Z. chose to seek alternative therapies in Mexico. Seven years after diagnosis, a CT scan revealed evidence of disease progression with an increased size of the right lung mass. Mr. Z. agreed to start chemotherapy, which included docetaxel/gemcitabine, pemetrexed, gefitinib, gemcitabine/irinotecan, and paclitaxel.

available and lung cancer a more common disease. Tobacco contains approximately 4,000 chemicals, including more than 400 proven carcinogens. About 87% of lung cancers are thought to result from smoking or passive exposure to tobacco smoke. The longer you smoke, and the more packs per day you smoke, the greater is your risk of developing lung cancer.

If you stop smoking before a cancer develops, your damaged lung tissue gradually starts to return to normal. Ten years after stopping smoking, your risk is reduced to about one-half of that if you had continued to smoke. Cigar smoking and pipe smoking are almost as likely to cause lung cancer as cigarette smoking. There is no evidence that smoking low-tar cigarettes reduces the risk of lung cancer.

If you have not quit smoking, you should stop as soon as possible if you are diagnosed with lung cancer. Quitting can reduce coughing and discomfort and improve your response to medication.

If you do not smoke, but breathe in the smoke of others (called second-hand smoke or environmental tobacco smoke), you are also at increased risk for lung cancer. A
nonsmoker who is married to a smoker has a 20% to 30% greater risk of developing lung cancer than the spouse of a nonsmoker. Workers who have been exposed to tobacco smoke in the workplace are also more likely to develop lung cancer.

**Marijuana** — Many of the cancer-causing substances in tobacco are also found in marijuana. Marijuana contains more tar than tobacco and is usually smoked all the way to the end where the tar content is the highest. Marijuana is also inhaled very deeply and the smoke is held in the lungs for a long time.

Medical reports suggest marijuana may cause cancers of the mouth and throat, but it has been hard to prove a connection because it is difficult to get reliable information about the use of illegal drugs. Many marijuana smokers also smoke cigarettes, making it difficult to separate the risks of marijuana from the risks of tobacco.

**Asbestos** — Exposure to *asbestos* fibers is another important risk factor for lung cancer. Current and former asbestos workers who also smoke have a lung cancer risk 50 to 90 times greater than the general population and are about seven times more likely to die of lung cancer. Smokers and non-smokers exposed to asbestos also have a greater risk of developing a type of cancer that starts in the *pleura* (the layer of cells that line the outer surface of the lung). This cancer is called *mesothelioma*.

The use of asbestos in commercial and industrial products has nearly stopped. Asbestos is still present in many homes and commercial buildings but is not considered harmful as long as it is not released into the air due to deterioration, demolition, or renovation.

**Other Carcinogens in the Work Environment** — Other *carcinogens* (cancer-causing agents) found in the workplace that can increase your lung cancer risk include:

- radioactive ores such as uranium
- chemicals such as arsenic, vinyl chloride, nickel chromates, coal products, mustard gas, and chloromethyl ethers
- fuels such as gasoline
- diesel exhaust

The government and industry have taken major steps in recent years to protect workers. But the dangers are still present; if you work around these agents, you should be very careful to avoid exposure.
Talc and Talcum Powder and Other Minerals — Talcum powder is made from talc, a mineral that in its natural form may contain asbestos. The use of cosmetic talcum powder has not been found to increase the risk of lung cancer, but all home-use talcum products (baby, body, and facial powders) have been asbestos-free by law since 1973.

People with silicosis and berylliosis (lung diseases caused by breathing in certain chemical elements) also have a higher risk of lung cancer.

Radon — When uranium breaks down naturally, it produces radon, a radioactive gas, which cannot be seen, tasted, or smelled. Outdoors, there is so little radon that it is not dangerous. But indoors, radon can become more concentrated and a possible risk factor for cancer. Studies have found that the risk of lung cancer may be doubled or even tripled if you have lived for many years in a house built over soil with natural uranium deposits that can create high indoor radon levels. This is a very small increase, however, compared with the lung cancer risk from tobacco.

“Talk to other cancer patients. It helps to know that you are not alone.”

Smokers are especially sensitive to the effects of radon. Workers exposed to high radon levels in mines also have an increased risk of lung cancer.

Air Pollution — In some cities, air pollution may slightly increase the risk of lung cancer. This risk is far less than that caused by smoking.

Recurring Inflammation — Tuberculosis and some types of pneumo-nia often leave scars on the lung. This scarring can increase your risk of developing a type of lung cancer called adenocarcinoma.

Personal and Family History — If you have had lung cancer already, you have a higher risk of developing another lung cancer. Brothers, sisters, and children of those who have had lung cancer may have a slightly higher risk of lung cancer. It is not known how much of this excess risk is due to inherited factors and how much is due to environmental tobacco smoke.

Diet — Some reports have indicated that a diet low in fruits and vegetables may increase your chances of getting cancer if you are exposed to tobacco smoke. Flavonoids, found in fruits and vegetables as well as green teas, may help protect you from lung cancer.

Gender — Several studies have shown that women may have a genetic predisposition to develop cancer when they are exposed to tobacco smoke. Women who smoke develop lung cancer with fewer cigarettes smoked over fewer years than do men who smoke.
THE LUNGS: FORM AND FUNCTION

The lungs are two sponge-like organs found in the chest. The right lung has three sections, called lobes. The left lung has two lobes. The left lung is smaller because the heart takes up more room on that side of the body. The lungs bring air in and out of the body, taking in oxygen and getting rid of carbon dioxide gas, a waste product.

The lining around the lungs, called the pleura, helps to protect the lungs and allows them to move during breathing. The windpipe (trachea) brings air down into the lungs. It divides into tubes called bronchi, which divide into smaller branches called bronchioles. At the end of these small branches are tiny air sacs known as alveoli.

Lung cancer often takes many years to develop. Precancerous changes may occur first. These changes do not form a mass or tumor, cannot be seen on an x-ray, and do not cause symptoms, but can be found by testing cells in the lining of the airways of the lungs.

As precancerous areas progress to become cancer, they may produce chemicals and proteins that cause new blood vessels to form nearby. These new blood vessels nourish the cancer cells and allow a tumor to form. After 7 to 15 years, the tumor often becomes large enough to be seen on an x-ray.

Once lung cancer occurs, cancer cells can break away and spread to other parts of the body in a process called metastasis. By the time lung cancer is detected, it often has already spread to other parts of the body and is life-threatening.
TYPES OF LUNG CANCER

There are two main types of lung cancer:

- Small-cell lung cancer (SCLC)
- Non–small-cell lung cancer (NSCLC)

Cancers with features of both types are called mixed small-cell/large-cell cancers.

**Small-Cell Lung Cancer** — About 10% to 15% of all lung cancers diagnosed are of the small-cell type. Although the cancer cells are small, they can multiply quickly and form large tumors that can spread to the lymph nodes and to other organs such as the brain, liver, and bones. Treatment must include drugs to kill widespread disease. This type of cancer is almost always caused by smoking; it is rare for someone who has never smoked to have small-cell lung cancer.

“My oncologists and the entire staff are really encouraging.”

**Non–Small-Cell Lung Cancer** — The other 85% to 90% of lung cancers diagnosed in patients are of the non–small-cell type. There are four subtypes within this group. The cells in these subtypes differ in size, shape, and chemical makeup.

- **Squamous cell carcinoma** is usually linked to a history of smoking. It tends to be found centrally, near a bronchus.
- **Adenocarcinoma** is usually found in the outer region of the lung.
- **Large-cell undifferentiated carcinoma** can appear in any part of the lung and tends to grow and spread quickly, resulting in a poor *prognosis* for the patient.
- **Bronchoalveolar carcinoma** appears in the outer regions of the lung and is a common type of lung cancer in nonsmokers.
Chapter 2

Diagnosis of Lung Cancer

JOHN P.—My advice would be to tell your doctor how you feel at the first signs of illness. Don’t wait and delay getting evaluated. My greatest fears were having to suffer from pain, having to tell my family that I had cancer, and having to undergo chemotherapy, with all the side effects I’d heard about.

My initial experience with chemotherapy was that I was becoming very tired and weak. I felt restless at times. My lifestyle has changed. I no longer am fearful since I have had chemotherapy treatments.

—John P.

If you have reason to suspect you may have lung cancer, your doctor will use one or more methods to find out if you do. A lung tissue biopsy is used to confirm the diagnosis of cancer and also provides information that will help in making treatment decisions. If lung cancer is diagnosed, more tests will be performed to find out how far the cancer has spread.

**Medical History and Physical Exam** — Your doctor will take a medical history to check for risk factors and symptoms. He or she will also examine you to look for signs of lung cancer and other health problems.

**Imaging Tests** — Imaging tests use x-rays, magnetic fields, or radioactive substances to create pictures of the inside of your body.

**Chest x-ray:** A chest x-ray will probably be the first test your doctor orders to look for any mass or spot on the lungs. If something suspicious is seen on the x-ray, your doctor may order additional tests.

**Computed tomography (CT):** The CT scan is an x-ray procedure that produces detailed cross-sectional images of your body. A CT scanner takes many pictures as it rotates around you; a computer combines these pictures into an image of a slice of your body.
After the first set of scans, you may receive an intravenous injection of a “dye” or radiocontrast agent to better outline body structures for a second set of pictures. Some people are allergic to the dye and may get hives, experience a flushed feeling, or rarely, have more serious reactions like trouble breathing and low blood pressure. If you have ever had a reaction to any contrast material used for x-rays, tell your doctor, who may prescribe medicine to take before the dye is injected. You may also be asked to drink a contrast solution, which outlines your intestines on the CT scan and enables your doctor to see if the lung cancer has spread.

**Case History #2**

John P. underwent a routine screening chest x-ray. He was 84 years old and had smoked 2 packs per day for 50 years, but had quit smoking 14 years earlier. The chest x-ray showed a questionable abnormality in the left upper lobe and a subsequent CT scan demonstrated a 3.4-cm left hilar mass. A PET scan demonstrated multiple areas highly suspicious for malignancy. Mr. P. had a bronchoscopy and a biopsy, which revealed locally advanced non–small-cell lung cancer. Following 3 months of treatment with carboplatin/paclitaxel, he is being closely monitored monthly.

A computed tomography (CT) scanner rotates around the patient taking pictures. A computer combines the pictures into an image. CT scans can determine whether lymph nodes and other organs are affected by the spread of lung cancer.
CT scans are more sensitive than routine chest x-rays in finding early lung cancers and provide precise information about the size, shape, and position of a tumor. CT scans can help find enlarged lymph nodes and masses in the adrenal glands, brain, and other internal organs that may be affected by the spread of lung cancer.

CT scans take longer than regular x-rays and you will need to lie still inside the ring of the scanner. If you feel too confined, your doctor can give you medication that may help you to relax.

*Magnetic resonance imaging (MRI):* MRI scans use radio waves and strong magnets instead of x-rays to obtain images of your body. A computer translates the pattern of radiowaves given off by the tissues into a very detailed image of parts of the body. MRI images are particularly useful in detecting lung cancer that has spread to the brain or spinal cord. Contrast materials are less often used with MRI than with CT scans. You do have to be confined inside a tube-like piece of equipment. Some facilities provide headphones with music to block out the thumping noise the machine makes. Again, however, if you feel uncomfortable about the procedure, talk to your doctor, who can discuss options to help you relax.

*Positron emission tomography (PET):* Positron emission tomography (PET) uses glucose (a form of sugar) that contains a radioactive atom. Cancer cells absorb large amounts of the radioactive sugar and a special camera detects the radioactivity. This is an important test for early-stage lung cancer. It can

“*My husband has been there with me every step of the way, every doctor visit, every treatment. He has never once complained. Without him, I wouldn’t have tried as hard to kick this cancer.*”

A PET scan is an important test for early-stage lung cancer, as it can help tell whether the cancer has spread to the lymph nodes or elsewhere in the body. These images are from a 63-year-old patient with lung cancer.
help tell whether a shadow on your chest x-ray is cancer and whether the
cancer has spread to your lymph nodes. If your doctor suspects that the
cancer has spread, a PET scan of the whole body may be done to identify
where the cancer has spread.

**Bone scans:** For a bone scan, a small amount of radioactive substance is
injected into a vein. The amount of radioactivity is very low and causes no
long-term effects. This substance builds up in areas
of bone that may be abnormal because of cancer metastasis, although other bone diseases can also
cause abnormal results. Bone scans are routinely
done in patients with small-cell lung cancer but not
in patients with non-small-cell lung cancer, unless
other tests or symptoms suggest that the cancer has spread to the bones.

**Procedures That Sample Tissues and Cells** — One or more
procedures that sample tissues and cells will be used to confirm that a mass
seen on imaging tests is a lung cancer, rather than a _benign_ condition. These
tests are also used to determine the type of lung cancer you may have and
whether it has spread.

**Sputum cytology:** A sample of _phlegm_ is examined under a microscope
to see if cancer cells are present. This test is not very accurate and therefore
not commonly used.

**Needle biopsy:** A sample of the mass is removed through a hollow needle
and examined under a microscope.

**Bronchoscopy:** For this procedure, you will be given a mild sedative to relax.
A flexible fiberoptic tube is passed through your nose into the _bronchi_ to help
find tumors or blockages in the lungs. Samples of tissue or secretions can be
taken and examined under a microscope for cancerous or precancerous cells.
Ongoing studies are exploring whether annual bronchoscopy will be beneficial
in finding precancerous changes in people at high risk for lung cancer.

**Mediastinoscopy and mediastinotomy:** For both of these procedures,
you will receive general anesthesia, which puts you in a deep sleep. With
mediastinoscopy a small cut is made in your neck and a hollow lighted tube
is inserted behind the _sternum_. Special instruments, operated through this
tube, can be used to take a tissue sample from the _mediastinal lymph nodes_
(those along the windpipe and the major bronchial tube areas). The samples
are then examined under a microscope to see if cancer cells are present.
Mediastinotomy is a surgical procedure that opens the chest cavity by cutting
through the _sternum_ or the ribs. This allows the surgeon to reach and remove
more lymph nodes.
Thoracentesis and thoracoscopy: These procedures are done to check whether a pleural effusion (accumulation of fluid around the lungs) is the result of cancer metastasis to the pleural membranes (the delicate membranes that cover the lungs), or because of a noncancerous condition such as heart failure or infection. For thoracentesis, a needle is placed between the ribs to drain the fluid, which is checked under a microscope for cancer cells. If cells are malignant, thoracentesis may be repeated to remove more fluid, which can help the patient breathe better. Thoracoscopy is a procedure that uses a thin, lighted tube connected to a video camera and monitor to view the space between the lungs and the chest wall.

Blood counts and blood chemistry: A complete blood count (CBC) determines whether your blood has the correct number of various cell types. For example, it can show if you have a low red blood cell count and have anemia. The CBC will be repeated regularly if you are treated with chemotherapy, because the drugs used temporarily affect blood-forming cells of the bone marrow. The blood chemistry tests also can detect abnormalities in some of your organs.

Tests to Determine Effective Treatment — After your lung cancer has been biopsied, the pathologist, in conjunction with your oncologist, may wish to do special genetic testing on the tumor. These tests could help your physician determine the treatments that are most effective and those that may not help. One of these tests is the EGF (epidermal growth factor) receptor test. The EGF receptor is found on a high percentage of lung cancer specimens. Certain new drugs, called EGF inhibitors, may require this receptor for clinical activity. Also, changes (mutations) in this receptor can cause the tumor to be very sensitive to these agents. Other tests that may help your physician are the K-ras and the excision repair cross-complementing (ERCC)-1 markers. The K-ras gene, when mutated, can lead to poor responses to EGF inhibitors. ERCC-1 expression in tumors may lead to resistance to some commonly used chemotherapy agents—the platinum compounds. Although these tests and others have been studied in patients with lung cancer, their true role is still being defined. Finally, it is important to note that these changes are often acquired by the tumor and not passed on from family members.

“There are a lot of simple little tasks that we take for granted until we can’t do them anymore.”
STAGING AND DIAGNOSIS OF NON–SMALL-CELL LUNG CANCER

Once testing is completed, the stage of your cancer can be determined. Staging describes the extent of your cancer, generally referred to as localized or widespread. Your treatment and prognosis (the outlook for chances of survival) depend on the stage of the cancer.

The system used to describe the growth and spread of non–small-cell lung cancer is the **TNM staging system**, also known as the American Joint Committee on Cancer (AJCC) system. \( T \) stands for tumor (its size and where it has spread); \( N \) stands for nodes (spread to lymph nodes); and \( M \) stands for metastasis (spread to distant organs). These are defined further in this chapter and in the appendix on page 53.

<table>
<thead>
<tr>
<th>Overall Stage</th>
<th>T Stage</th>
<th>N Stage</th>
<th>M Stage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Stage 0</td>
<td>Tis (in situ)</td>
<td>N0</td>
<td>M0</td>
</tr>
<tr>
<td>Stage IA</td>
<td>T1</td>
<td>N0</td>
<td>M0</td>
</tr>
<tr>
<td>Stage IB</td>
<td>T2</td>
<td>N0</td>
<td>M0</td>
</tr>
<tr>
<td>Stage IIA</td>
<td>T1</td>
<td>N1</td>
<td>M0</td>
</tr>
<tr>
<td>Stage IIB</td>
<td>T2</td>
<td>N1</td>
<td>M0</td>
</tr>
<tr>
<td></td>
<td>T3</td>
<td>N0</td>
<td>M0</td>
</tr>
<tr>
<td>Stage IIIA</td>
<td>T1</td>
<td>N2</td>
<td>M0</td>
</tr>
<tr>
<td></td>
<td>T2</td>
<td>N2</td>
<td>M0</td>
</tr>
<tr>
<td></td>
<td>T3</td>
<td>N1</td>
<td>M0</td>
</tr>
<tr>
<td></td>
<td>T3</td>
<td>N2</td>
<td>M0</td>
</tr>
<tr>
<td>Stage IIIB</td>
<td>Any T</td>
<td>N3</td>
<td>M0</td>
</tr>
<tr>
<td></td>
<td>T4</td>
<td>Any N</td>
<td>M0</td>
</tr>
<tr>
<td>Stage IV</td>
<td>Any T</td>
<td>Any N</td>
<td>M1</td>
</tr>
</tbody>
</table>

Once the T, N, and M categories have been assigned, this information is combined (stage grouping) to assign an overall stage of 0, I, II, III, or IV. Patients with lower stage numbers have a better prognosis (see Table 1, page 22).

**Non–Small-Cell Lung Cancer Survival by Stage** — Survival rates vary with the type of non–small-cell lung cancer and are based on patients diagnosed and initially treated more than 5 years ago (Table 2). Improvements in treatment often result in a more favorable outlook for recently diagnosed patients.

<table>
<thead>
<tr>
<th>Stage</th>
<th>5-Year Survival Rate</th>
</tr>
</thead>
<tbody>
<tr>
<td>I</td>
<td>47%</td>
</tr>
<tr>
<td>II</td>
<td>26%</td>
</tr>
<tr>
<td>III</td>
<td>8%</td>
</tr>
<tr>
<td>IV</td>
<td>2%</td>
</tr>
</tbody>
</table>

Table 2. Survival at 5 years by stage.


**STAGING AND DIAGNOSIS OF SMALL-CELL LUNG CANCER**

Although small-cell lung cancers can be staged like non–small-cell lung cancer, most doctors prefer a two-stage system: “limited stage” and “extensive stage.” Limited stage usually means that the cancer is only in one lung and in lymph nodes on the same side of the chest.

Spread of the cancer to the other lung, to lymph nodes on the other side of the chest, or to distant organs indicates extensive disease. Many doctors consider small-cell lung cancer that has spread to the fluid around the lung to be extensive-stage lung cancer. Small-cell lung cancer is staged in this way because it helps separate patients who have a fair prognosis and may be cured, from those who have a smaller chance of cure. Treatment options can vary depending on your prognosis; your doctor can discuss these options based on your individual case. About two-thirds of the people with small-cell lung cancer have extensive disease when cancer is first found.
Chapter 3
Multidisciplinary Treatment

LAVERNE K.—I was in the hospital for my heart and having stents placed. However, after a few more tests and extra days in the hospital, I was told that I had small-cell lung cancer. I felt numb and scared. I did not feel like I had lung cancer—I wasn’t sick. Then I was told that the doctors could not operate. That scared me more, because I was wondering why others could have an operation to remove a tumor and I couldn’t? I felt like my world just turned upside down. Why did this have to happen to me, why now? Would people treat me differently? Would anyone care? Would I understand what the doctors were telling me? My life is different now.

—Laverne K.

NON–SMALL-CELL LUNG CANCER

Multidisciplinary treatment refers to treatment with surgery, chemotherapy (anticancer drugs), and radiation. Newer treatments may also be used.

Stage 0: Stage 0 lung cancers are very rare. These cancers are limited to the lining layer of air passages, have not invaded the nearby lung tissue, and are curable by surgery alone. No chemotherapy or radiation therapy is needed. Your doctor will talk to you about treatments to try to prevent the development of more advanced stages of disease.

Tumors can be removed by procedures known as segmentectomy (surgical removal of defined segments) or wedge resection (surgical removal of small wedges). Cancers in some locations (where the trachea divides into the left and right main bronchi) are difficult to remove completely without also removing an entire lung.
Case History #3

Laverne K. originally had complaints of chest tightness and shortness of breath. These symptoms got progressively worse over a few weeks. She also had an occasional dry cough and slight breathing problems during exertion, and she tired easily with activity. Her smoking history included one pack per day for 20 years. She lost approximately 10 pounds over 3 to 4 months. She was admitted to the hospital for heart testing. A chest x-ray revealed a left mid-lung nodule and a CT scan revealed extensive hilar and mediastinal lymphadenopathy with a small nodule in the left mid-lung. She had angioplasty with stent placement and a bronchoscopy and lung biopsy, which revealed small-cell lung cancer. The bone scan indicated the possibility of bone metastasis. Mrs. K. received palliative chemotherapy, followed by whole brain radiation, and then further chemotherapy.

Endoscopic photodynamic therapy kills cancer cells by sensitizing them with an injected chemical and then shining a bright light on the cancer. This method is being tested as an alternative to surgery for stage 0 cancers.

Stage I: Stage I non–small-cell lung cancer is usually treated by surgery. This can involve removing the tumor, segmentectomy or wedge resection, or removing a lobe of the lung, lobectomy. Most surgeons believe it is better to perform a lobectomy, though this decision is made based on the individual patient. Some patients may receive radiation therapy as their main treatment, with chemotherapy added to increase the effectiveness.

Studies of additional (adjuvant) chemotherapy after surgery for stage I non–small-cell lung cancer have demonstrated that this can improve survival compared with surgery alone. Adjuvant chemotherapy is recommended for those patients who can tolerate the additional therapy and may also be used for those who cannot tolerate surgery and are treated with radiation only.

Stage II: Stage II non–small-cell lung cancers are surgically removed by lobectomy, wedge resection, or segmentectomy. It is sometimes necessary to remove the whole lung (pneumonectomy). Radiation therapy may be used to destroy cancer cells left behind after surgery, especially if cancer cells are present at the edge of the tissue removed by surgery. Even if the edges of the sample have no detectable cancer cells, some doctors may recommend additional radiation therapy. If you have serious medical problems, you may receive only radiation therapy as your main treatment.
Stage IIIA: Treatment for stage IIIA non–small-cell lung cancer depends on where the cancer is located and to which lymph nodes it has spread. Surgery may be used if your surgeon thinks all the cancer can be removed successfully. Some doctors recommend that chemotherapy or radiation therapy or both be given before surgery, with the goal of shrinking the tumor enough so that it can be completely removed by surgery.

Recent studies have shown that preoperative chemotherapy may prolong survival and increase the chance of cure. You may also receive radiation therapy, sometimes along with chemotherapy, after the surgery. If you can’t have surgery because of other serious medical conditions, you can be treated by radiation therapy alone or by both radiation therapy and chemotherapy.

*Brachytherapy* is the placement of radioactive “seeds” into the lung at the area of the tumor. In some cases, a *laser* can be passed through a bronchoscope to destroy part of the cancer within the airway. Both of these methods are used to try and shrink a cancer and, if the tumor had caused the lung to close up, to open up the lung again.

Stage IIIB: Stage IIIB non–small-cell lung cancer has spread too widely to be completely removed by surgery. If you are in relatively good health, you may be helped by combined chemotherapy and radiation therapy, in some cases followed by surgery. Several clinical trials are in progress to determine the best treatment for people with stage IIIB non–small-cell lung cancer.

Stage IV: Because stage IV non–small-cell lung cancer has spread to distant organs, a cure is usually not possible. You should discuss treatment goals with your doctor, because some treatments can help you to be more comfortable. If you are in otherwise good health, chemotherapy can help you live longer and feel better, even though it will not cure you. A tumor blocking an airway can be treated by *brachytherapy* or by using a laser passed through a bronchoscope. *External beam radiation therapy* can also treat complications of cancer in the lungs as well as problems from metastatic growth such as bone pain and spread to the brain.

Three new drugs that inhibit the *epidermal growth factor receptor* (a growth-regulating protein present on the surface of many lung cancer cells) have been investigated in some patients who have already had chemotherapy for non–small-cell lung cancer, including *bronchoalveolar* carcinomas. Gefitinib and erlotinib have been shown to be effective in this setting. Cetuximab is well tolerated and its role in these patients is under investigation.

If you have extensive cancer, are not being helped by chemotherapy, or are in otherwise poor health, you might want to consider *palliative care*,
aimed at relieving pain and increasing comfort, perhaps in the setting of a good hospice program (see section on supportive care). You may also want to consider participating in a clinical trial (see page 46).

SMALL-CELL LUNG CANCER

Studies show that small-cell lung cancer has usually spread by the time it is found in the majority of patients (even if that spread is not shown by x-rays and other imaging tests), so SCLC usually cannot be cured by surgery alone.

**“Sometimes it felt like I wasn’t getting any better, but the staff at the oncology office were very encouraging.”**

Limited stage — Even if you have limited-stage small-cell lung cancer, you will receive chemotherapy. If you only have a single nodule in your lung and no evidence of cancer elsewhere, your doctors may recommend that the nodule be surgically removed before chemotherapy is started. The most commonly used treatment is a combination of two or more chemotherapy drugs. The combination of cisplatin or carboplatin and etoposide is usually given for around 4 to 6 months. Clinical trials are being done to see if adding topotecan or irinotecan will improve survival.

Studies have shown that radiation treatment to the chest (usually the middle where the cancer spreads to lymph nodes) improves your survival compared with chemotherapy alone, particularly when radiation is administered early. The radiation is often given along with the chemotherapy, although this increases the side effects of treatment. You may have more trouble breathing because of lung damage and trouble swallowing because of the effect of radiation on your esophagus.

You will not be given chest radiation therapy if you have severe lung disease or other types of serious health problems. If the cancer is very localized, it can sometimes be treated by surgery followed by combination chemotherapy.
If you are treated with chemotherapy, with or without radiation therapy, it is likely that your tumor will shrink and you will go into remission. Sooner or later, though, your cancer may begin to grow again.

The 1-year survival rate for people with limited-stage small-cell lung cancer treated with chemotherapy and radiation therapy is 62% to 66%. It decreases to 30% to 37% at 2 years, and 15% to 20% by 5 years. These low survival rates have led to clinical trials of new chemotherapy drugs or other new treatments such as immunotherapy or gene therapy (see page 30).

**Extensive stage**—If you have extensive small-cell lung cancer, chemotherapy can treat your symptoms and allow you to live longer. The chance of your cancer shrinking with chemotherapy is about 70% to 85%. Carboplatin or cisplatin is usually given along with etoposide. Some doctors favor giving large doses of chemotherapy along with drugs that build up the blood cell count (colony-stimulating factors). It still is not clear if this approach improves the results of chemotherapy. New combinations of cisplatin with irinotecan have shown promising results, but the cancer eventually becomes resistant to the chemotherapy.

Patients with extensive-stage disease who respond to initial chemotherapy may benefit from the addition of radiation therapy to the brain and possibly to the chest. The 1-year survival rate for people with extensive small-cell lung cancer is about 22% to 48%. This falls to 5% to 19% by 2 years and 1% to 8% by 5 years.

**Recurrent Disease**—Although the majority of patients with SCLC will respond to treatment, unfortunately relapse is likely to occur. When SCLC returns more than 2 years after successful treatment, it is referred to as recurrent disease. The news of recurrent disease can be frightening, but there are treatment options your health care team can discuss with you. Understanding the goals of therapy for recurrent disease is important. These may focus more on preserving a good quality of life and managing symptoms than on cure.

One factor to consider in determining which treatment option may be most appropriate for you includes your performance status at the time of relapse. For some patients, retreatment with the same chemotherapy used in a first-line setting may be an option. For others, including older patients or those with a poor performance status who may not tolerate aggressive combination chemotherapy well, treatment with a single drug may be an effective alternative.

While no single chemotherapy regimen should be considered standard, topotecan is the only agent approved by the FDA for use as single-agent
therapy for recurrent SCLC. Topotecan capsules are the only oral single-agent chemotherapy approved for the treatment of SCLC after failure of first-line therapy. The availability of an oral treatment may assist some patients with SCLC in maintaining a higher quality of life, compared with chemotherapy administered intravenously. Others that have shown activity in recurrent SCLC are combination cyclophosphamide/doxorubicin/vincristine, single-agent oral etoposide, combination etoposide/cisplatin, and single-agent paclitaxel. If you are too ill to have chemotherapy, supportive care may be the best option (see page 50).

Drugs Mentioned in This Guide

Most drugs are known by three different names: (1) the chemical name; (2) the generic or nonproprietary name, and (3) the trade, brand, or proprietary name. Chemical names represent the exact description of the drug’s chemical composition. A generic name is assigned by the manufacturer and generally is a simpler version of the chemical name. Trade or brand names of drugs are copyrighted by the company selling the drug. This means other companies cannot sell a copyrighted drug by that same brand name. Other companies may produce and market that same drug with the same generic name, but their own trade name, once a company’s patent on a particular drug is expired. For purposes of this guide, we use only the generic name in the text. For reference, however, a list of the generic and trade names of these agents where applicable is provided below.

<table>
<thead>
<tr>
<th>Drug Name</th>
<th>Trade Name</th>
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<tbody>
<tr>
<td>Actinomycin-D</td>
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<td>Cisplatin (Platinol)</td>
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<td>Carboplatin (Paraplatin)</td>
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<td>Capecitabine (Xeloda)</td>
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<td>Cefximab (Erbitux)</td>
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<td>Darbepoetin alfa (Aranesp)</td>
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<td>Daunorubicin</td>
<td>Methotrexate</td>
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<td>Docetaxel (Taxotere)</td>
<td>Oprelvekin (Neumega)</td>
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<td>Doxorubicin (Adriamycin)</td>
<td>Oxaliplatin (Eloxatin)</td>
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<td>Epoetin alfa (Procrit, Epogen)</td>
<td>Paclitaxel (Taxol)</td>
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<tr>
<td>Erlotinib (Tarceva)</td>
<td>Pemetrexed (Alimta)</td>
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<td>Etoposide (VePesid)</td>
<td>Temozolomide (Temodar)</td>
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<td>Exisulind (Aptosyn)</td>
<td>Thalidomide (Thalomid)</td>
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<td>Fluorouracil (5-FU)</td>
<td>Topotecan (Hycamtin)</td>
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<td>G-CSF (granulocyte-colony stimulating factor; Neulasta, Neupogen)</td>
<td>Vinorelbine (Navelbine)</td>
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<tr>
<td>GM-CSF (granulocyte-macrophage colony-stimulating factor; Leukine)</td>
<td>Vincristine</td>
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Brain metastasis — Small-cell lung cancer commonly spreads to the brain. If no preventive measures are taken, about 50% of people with small-cell lung cancer will have metastasis to the brain. Those who respond well to initial treatment may receive radiation therapy to the brain to try to prevent metastasis. This is called prophylactic cranial irradiation (PCI), which may slightly increase your chance of longer survival. Some patients may suffer side effects such as trouble with memory and clumsiness, although it is not clear whether these symptoms are a direct result of the radiation.
Chapter 4
Side Effects of Treatment

Marilyn Y.—Finding out I had cancer yanked my world out from under me. My fears were if I died what would my family do without me? Another fear was losing my hair. I was always so particular about my hair, and was told after my first treatment that I would lose my hair within 3 weeks. I cried for days. So I had to buy a wig (actually two). Sometimes I wear hats, but I am not too fond of hats either. What I do is live with it and thank God that I am still here.

The oncology staff and my doctor have helped me a great deal. I have the most wonderful oncology doctor in the world. He is caring, compassionate and has helped me through my illness.

My life with chemotherapy has not bothered me that much. However, about the third or fourth day after treatment, the side effects start to bother me, including aching, nausea, and having no appetite. I really did not have a great deal of problems, except when I first started. I was on a clinical trial drug called gefitinib (Iressa). I had to have a Port-a-Cath in my chest for my intravenous therapy. I had to wear a small pump to receive my chemotherapy infusion. Unfortunately, my port got infected and I had to have it removed. After that, I received chemotherapy through a catheter inserted in a vein in my hand.

Keep a positive attitude. Try to keep yourself looking good. And keep telling yourself you are going to beat this cancer.

—Marilyn Y.
Although chemotherapy is given to kill cancer cells, it also can damage normal cells. Most likely to be damaged are normal cells that divide rapidly—those of bone marrow/blood, hair follicles, and the reproductive and digestive tracts. Damage to these cells accounts for many of the side effects of chemotherapy. Side effects differ based on the particular drug, the dosage, and how the drug is given, as well as an individual patient’s response. Some side effects are easily controlled; others require specialized care.

**Bone Marrow Suppression** — The bone marrow is the tissue inside some bones that produces white blood cells (WBCs), red blood cells (RBCs), and blood platelets. Damage to the bone marrow tissue is called bone marrow suppression, or myelosuppression. It is one of the most common side effects of chemotherapy.

Case History #4

Marilyn Y. was in good health until age 62, when she began to have increasing shortness of breath during exertion and sinus problems. She had smoked 1½ packs per day for 25 years, but had quit smoking at age 41. When breathing and sinus problems developed at age 62, antibiotics were prescribed but produced no improvement. A chest x-ray showed an abnormality in her right lower lung and a lobectomy was performed. The tumor was a moderately differentiated adenocarcinoma with involvement of surface of the pleura. Follow-up chest x-rays showed she was doing well until age 64. A biopsy 1 month later confirmed that the adenocarcinoma had recurred. Mrs. Y.’s chemotherapy regimens have included 4 months on carboplatin/paclitaxel and 3 months in a clinical trial with gefitinib. She also received docetaxel and participated in a clinical trial testing exisulind vs placebo.

Cells produced in the bone marrow tissue are growing rapidly and are sensitive to the effects of chemotherapy. Until your bone marrow cells recover from this damage, you may have abnormally low numbers of WBCs, RBCs, and/or blood platelets. While you are getting chemotherapy, your blood will be regularly sampled and the numbers of these cells can be assessed by a complete blood count (CBC).

The decrease in blood cell counts does not occur immediately after chemotherapy because the drugs do not destroy the cells already in the bloodstream (which are not dividing rapidly). Instead, the drugs temporarily prevent formation of new blood cells by the bone marrow and the blood cell levels will begin to drop. The type and dose of the chemotherapy influences when and how low the blood cell counts drop.
Each type of blood cell has a different function and life span:

- White blood cells help the body fight infections and average a 6-hour lifespan.

- Platelets help prevent bleeding by forming plugs to seal up damaged blood vessels and average 10 days.

- Red blood cells bring oxygen to tissues so cells throughout the body can turn certain nutrients into energy. They average 120 days.

The lowest count that blood cell levels fall to is called the nadir. The nadir for each blood cell type will occur at different times but WBCs and platelets will usually reach their nadir within 7 to 14 days. RBCs live longer and will not reach a nadir for several weeks.

Low white blood cell counts: Blood normally has between 4,000 and 10,000 WBCs per cubic millimeter. Leukopenia is the medical term for a low WBC count. Neutropenia, an abnormally low number of neutrophils, is the most common factor that puts people with cancer at risk for infection. The normal range of neutrophils is between 2,500 and 6,000 cells per cubic millimeter. The absolute neutrophil count (ANC) is calculated to determine the likelihood of developing an infection. Someone with an ANC of 1,000 or less is considered to be neutropenic and at risk of developing an infection. An ANC lower than 500 is considered severe neutropenia.

A low WBC or neutrophil count puts you at risk for infection. Fever may be the first sign of an infection. Usually you will be instructed to call your doctor or nurse if you have a fever greater than or equal to 100.5 F, shaking chills, or other signs of infection. These could include sore throat, new cough or shortness of breath, nasal congestion, burning sensation during urination, and redness, swelling, and warmth at the site of an injury.

Because of the risk of infections, additional chemotherapy doses may be delayed when you have a very low white blood cell count. In some situations, doctors may prescribe colony-stimulating growth factors to keep the WBCs from falling too low.

Your body normally produces several growth factors (also called colony-stimulating factors) to stimulate the production of various types of blood cells. But the levels of these factors in the body are often not enough to keep up with demands during chemotherapy.

The two growth factor medications that stimulate production of white blood cells are granulocyte-macrophage colony-stimulating factor (GM-CSF) and granulocyte colony-stimulating factor (G-CSF). These drugs are often
given daily, starting the day after you receive chemotherapy, for up to 2 weeks. A newer, longer lasting form of G-CSF may need to be given only once each chemotherapy cycle.

These drugs help bone marrow recover more quickly and reduce your risk of getting a serious infection. They are given intravenously (IV) or subcutaneously (SC) as injections under the skin.

"My hair began to fall out after 2 weeks of treatment. I think that was when I finally realized I had lung cancer."

Low red blood cell counts: Not having enough red blood cells is called anemia. Anemia can cause fatigue, dizziness, headaches, irritability, shortness of breath, and an increase in the heart or breathing rate or both.

Doctors use two measurements to determine if you have enough RBCs.

- The red pigment in RBCs that carries oxygen is hemoglobin. If there are not enough RBCs, the blood hemoglobin concentration will be less than its usual range of 12 to 16 grams per deciliter (g/dL) in women or 14 to 18 g/dL in men.

- Hematocrit is the percentage of total blood volume occupied by red blood cells. Its normal range is between 37% and 52%. Levels are normally higher for men than for women.

Anemia caused by chemotherapy is usually temporary, but bleeding caused by surgery or the cancer itself can make anemia even worse. Blood transfusions may be needed until the bone marrow is healthy enough to replace worn-out RBCs. Blood transfusions have some risks and are used only in cases of significant signs and symptoms, such as shortness of breath and/or very low RBC counts.

Another option for treating anemia caused by chemotherapy is to use erythropoietic agents, which stimulate RBC production by bone marrow cells and can relieve symptoms of anemia and reduce the need for blood transfusions. Erythropoietic agents, such as epoetin alfa, are generally given weekly or every other week by injection under the skin (SC) until the hemoglobin level increases to 12 g/dL. A newer, longer lasting form, known as darbepoetin alfa, may reduce the number of injections to every 2 to 3 weeks.

Low platelet counts: The normal range for platelet counts is between 150,000 and 450,000 per cubic millimeter. The medical term for a low platelet count is thrombocytopenia.
If your platelet count is low, you may show these signs:

- Bruise easily.
- Bleed longer than usual after minor cuts or scrapes.
- Have bleeding gums or nosebleeds.
- Develop ecchymoses (large bruises) and petechiae (multiple small bruises).
- Have serious internal bleeding if the platelet count is very low.

Although low platelet counts resulting from chemotherapy are temporary, they can cause serious blood loss from injury or bleeding that can damage internal organs. Sometimes a low platelet count will delay necessary surgery because doctors are concerned about blood loss during surgery. If platelet counts are very low (below 10,000) or if a person with moderately low counts has greater than normal bleeding or bruising, platelet transfusions may be given.

Transfused platelets last only a few days, and some people who have received many platelet transfusions can develop an immune reaction that destroys donor platelets. A platelet growth factor called orelvekin can decrease the need for platelet transfusions among people with severe thrombocytopenia.

**Hair Loss** — Chemotherapy affects the rapidly growing cells of hair follicles. Your hair may become brittle and break off at the surface of the scalp, or it may simply fall out from the hair follicle. Hair loss depends on which drugs are given, their doses, and the length of treatment. If hair is going to be affected, you may see it happen 2 to 3 weeks after treatment begins. Hair loss from chemotherapy is almost always temporary. When your hair grows back, its color or texture may be different. Hair may start to grow again near the end of your treatment or after the treatment is completed.

Hair loss can vary greatly with the individual. Some people may have complete loss of hair while others may see just a thinning of their hair. Loss of eyebrows, eyelashes, pubic hair, and body hair is usually less severe because the growth is less active in these hair follicles than in the scalp. Although hair loss is not life threatening, it may cause depression, loss of self-confidence, and grief reactions.

**Appetite Loss and Weight Loss** — Most chemotherapy drugs cause some degree of anorexia, a decrease in or loss of appetite. Severe anorexia
I knew having chemotherapy was what I needed to do to beat this cancer.

Taste Changes — Cancer treatments and the cancer itself can change the way some food tastes. You may experience an increased desire for sweet foods, or conversely a dislike for sweet foods, foods with bitter tastes, beef or pork, or tomatoes and tomato products. You may also have a constant metallic or medicinal taste in your mouth. Taste changes can contribute to anorexia and malnutrition. Changes in taste and smell may continue as long as chemotherapy treatments continue, or longer, but usually return to normal several weeks after chemotherapy has ended.

Stomatitis and Esophagitis — Stomatitis refers to the inflammation and sores in your mouth that may result from chemotherapy. Similar changes in the throat or the esophagus are called pharyngitis and esophagitis. The term mucositis refers to inflammation of the lining layer of the mouth, throat, and esophagus.
The lining of the mouth may first appear pale and dry. Later, the mouth, gums, and throat may feel sore and become red and inflamed. The tongue may be “coated” and swollen, leading to difficulty swallowing, eating, or talking. *Stomatitis, pharyngitis, and esophagitis* can lead to bleeding, painful ulceration, and infection.

Mouth, throat, and esophagus sores are temporary and usually develop 5 to 14 days after receiving chemotherapy. They heal completely once chemotherapy is finished.

**Nausea and Vomiting** — Chemotherapy agents cause *nausea* and *vomiting* for a variety of reasons, including irritating the lining of the stomach and *duodenum* (the first section of the small intestine).

Nausea is an unpleasant wavelike sensation in the stomach and back of throat. It can be accompanied by symptoms such as sweating, light-headedness, dizziness, and weakness. It can lead to retching, vomiting, or both. Vomiting is a process controlled by the vomiting center that causes the contents of the stomach to be forced out through the mouth. Vomiting can be *acute*, occurring within minutes to hours after chemotherapy, or delayed, developing or continuing for 24 hours after chemotherapy and sometimes lasting for days. *Anticipatory vomiting* occurs when a bad experience that prompted nausea and vomiting in the past causes nausea and vomiting in similar situations (for example, before receiving the next chemotherapy treatments).

New medications are available to both prevent and treat nausea and vomiting. Nondrug methods that can help with nausea and vomiting include ginger ale or ginger in tablets, relaxation exercises, guided imagery, and soothing music.

**Constipation** — *Constipation* is the passage (usually with discomfort) of infrequent, hard, dry stool. If you experience constipation, you may also experience excessive straining, bloating, increased gas, cramping, pain, or *hemorrhoids*. Constipation affects about half of people with cancer and about three out of four of those with advanced disease.

Certain chemotherapy agents can cause constipation, as can *opioid* pain medications. Other risk factors include decreased physical activity, poor diet, decreased fluid intake and dehydration, being confined to bed rest, and depression. If constipation develops, your doctor will try to determine the cause, then take appropriate measures to treat the problem.

**Diarrhea** — Diarrhea is the passage of loose or watery stools three or more times a day. You may have gas, cramping, and bloating. Diarrhea occurs
in about three out of four people who receive chemotherapy because of the
damage to the rapidly dividing cells in the digestive tract. Certain chemother-
aphy drugs are more likely to cause diarrhea. Examples include irinotecan,
fluorouracil, methotrexate, docetaxel, actinomycin-D, and capecitabine.
Receiving both radiation and chemotherapy and higher doses and longer
length of treatment also increase the chances of diarrhea. Other factors
increasing the likelihood of developing diarrhea include having a stomach
tumor and being lactose intolerant (getting sick from drinking milk, for
example).

Diarrhea can be serious and become life threatening if dehydration,
malnutrition, and electrolyte imbalances occur. It is important to report any
diarrhea to your doctor or nurse. Keep a record of the number of times you
have diarrhea, the amount, and the appearance, and give this information
to your doctor. Sometimes your doctor will prescribe medications such as
Imodium or Lomotil to help treat diarrhea symptoms.

**Fatigue** — Fatigue is a common side effect of cancer and chemotherapy.
You may experience weakness, lack of energy, forgetfulness, inability to
concentrate, and decreased ability for physical and mental work. The fatigue
you feel with cancer is different from the fatigue of everyday life. Fatigue
with cancer is unrelated to activity, may not go away with rest or sleep, and
can be long-lasting and affect your quality of life.

**Heart Damage** — Certain chemotherapy drugs can damage the heart.
The most common ones are daunorubicin and doxorubicin. Heart damage
occurs in about 1 in 10 people who receive accumulated doses of doxorubicin
greater than \(550 \text{ mg/m}^2\). If you have had radiation to the mid-chest area
before, existing heart problems, uncontrolled high blood pressure, or are a
smoker, you will be at higher risk for heart damage.

Heart damage from chemotherapy may cause erratic heartbeats. Other
symptoms include puffiness or swelling in the hands and feet, shortness of
breath, dizziness, and dry cough.

Before you receive a drug that can damage the heart, your doctor will
check your heart function to make sure that there are no major problems.
During treatments, your heart function will be checked to ensure that no
changes have occurred. Tests such as an electrocardiogram (ECG), an
echocardiogram, or a MUGA scan are done to check for any changes in heart
function. If problems develop, the chemotherapy drug will be stopped to
prevent further permanent damage. Notify your doctor or nurse if you
notice changes in your heart rhythm, weight gain, or fluid retention.
**Nervous System Changes** — Some chemotherapy drugs can cause direct or indirect changes in the *central nervous system* (brain and spinal cord), the *cranial nerves*, or *peripheral nerves*. Side effects resulting from nerve damage can occur soon after chemotherapy or years later.

The cranial nerves are connected directly to the brain and are important for movement and touch sensations of the head, face, and neck. Cranial nerves are also important for vision, hearing, taste, and smell. Damage to the cranial nerves may cause visual difficulties (such as blurred vision or double vision), increased sensitivity to odors, hearing loss or ringing in the ears, and dry mouth.

Peripheral nerves lead to and from the rest of the body and are important in movement, touch sensations, and regulating activities of some internal organs. Peripheral nervous system changes usually affect the hands and feet and can include numbness, tingling, and decreased sensation. This may make you feel clumsy and cause difficulty in daily activities such as opening jars or squeezing toothpaste tubes.

One of the most commonly used drugs that causes peripheral nerve damage is vincristine. Other drugs include oxaliplatin, paclitaxel, vinorelbine, and thalidomide. Decreasing or stopping the chemotherapy usually causes symptoms to decrease or disappear. At times, however, the damage may be permanent.

**Cognitive Changes** — Recent research has shown that chemotherapy can affect the way your brain functions many years after treatment. This occurs in a small number of patients and is often worse with larger doses of chemotherapy drugs. Some of the brain’s activities that are affected are concentration, memory, comprehension (understanding), and reasoning. People who have cognitive problems due to chemotherapy notice the differences in their thinking and sometimes call this experience “chemo-brain.”

Researchers are currently looking for ways to help prevent and treat cognitive impairment for chemotherapy patients. Programs currently available can help you improve your memory and problem-solving abilities. Simply being aware that problems with thinking can occur may help patients and their family members feel less isolated and alone.

**Lung Damage** — Some chemotherapy drugs, such as bleomycin, can cause irreversible damage to the lungs. The likelihood of this occurring increases if you receive radiation to the chest in addition to chemotherapy. Age also seems to be an important factor. For example, people over 70 years old have three times the risk of developing lung problems from bleomycin.
Reproduction and Sexuality

Reproductive and sexual problems that can occur after chemotherapy depend on your age when you are treated, the dose and duration of the chemotherapy, and the chemotherapy drug(s) that are given.

Sexual changes men may experience:

• Some men receiving chemotherapy may have problems with erections, although most men still have normal erections.

• Erections and sexual desire often decrease just after a course of chemotherapy but usually recover in a week or two. A few chemotherapy drugs, for example, cisplatin or vincristine, can permanently damage parts of the nervous system.

• Chemotherapy can sometimes affect sexual desire and erections by slowing down the amount of testosterone produced. Some of the medications used to prevent nausea during chemotherapy can also upset a man’s hormonal balance, but hormone levels should return to normal after treatments have ended.

• Many chemotherapy drugs can affect sperm and the organs that produce them. Some of these effects may be permanent. Some drugs are highly toxic and may cause birth defects. Sexually active men are advised to use reliable birth control. Men who wish to father children later in life might consider freezing sperm prior to chemotherapy.

Sexual changes women may experience:

• Many chemotherapy drugs can damage a woman’s ovaries, reducing their output of hormones. This affects fertility and libido. Ovarian function is less likely to return in women over age 30 and they are therefore more likely to go into menopause.

• Although chemotherapy may disrupt your menstrual cycles, it may still be possible to get pregnant. If you do not want to become pregnant, always use birth control.

• Symptoms of early menopause include hot flashes, vaginal dryness and tightness during intercourse, and irregular or no menstrual periods. As the lining of the vagina thins, light spotting of blood after intercourse becomes common.

• Some chemotherapy drugs irritate all mucous membranes in the body. This includes the lining of the vagina, which often becomes dry and inflamed.

• Vaginal infections are common during chemotherapy, particularly in women taking steroids or powerful antibiotics used to prevent bacterial infections. Yeast infections can often be prevented by not wearing pantyhose, nylon panties, and tight pants. Loose clothing and cotton panties let the vagina breathe. Your doctor may also prescribe a vaginal cream or suppository to help relieve symptoms.

• Men and women who have had genital herpes or genital wart infections in the past may have flare-ups during chemotherapy. It is especially important to have infections treated if you are taking chemotherapy, which weakens your body’s immune system and makes any infection a greater problem.

Lung damage may cause symptoms such as shortness of breath, a dry cough, and possibly fever. If the chemotherapy drug is stopped early enough, the lung tissue can regenerate. Because early lung changes may not show up on a chest x-ray, your doctor may assess your lungs through pulmonary function tests and arterial blood gas tests.

**Liver Damage** — The liver metabolizes, or breaks down, most chemotherapy drugs that enter the body, but some drugs can cause liver damage. These include methotrexate, cytarabine, high-dose cisplatin, high-dose cyclophosphamide, vincristine, vinblastine, and doxorubicin. Most often the damage is temporary, and the liver recovers a few weeks after the drug is stopped.

Signs of liver damage include a yellowing of the skin and the whites of the eyes (jaundice), fatigue, and pain under the lower part of the right ribs or right upper abdomen.

Blood tests will be needed to watch for possible liver damage. Older people and those who have hepatitis may be more likely to develop liver damage.

**Kidney and Urinary System Damage** — Many of the breakdown products of chemotherapy drugs are excreted through the kidneys. These drug byproducts can damage the kidneys, ureters, and bladder. Certain chemotherapy drugs such as cisplatin, high-dose methotrexate, ifosfamide, and streptozocin are more likely to cause kidney and urinary damage than other medications. If you have a history of kidney problems, you may be at a higher risk for kidney damage from chemotherapy.

Signs of possible kidney problems include lower back pain, fatigue, nausea and vomiting, headache, swelling or puffiness, or changes in urination and the color of the urine. Blood tests to measure kidney function should be performed regularly to look for any changes.

**Long-Term Side Effects of Chemotherapy** — Side effects related to specific chemotherapy drugs can continue after the treatment is completed. These effects can progress and become chronic, or new side effects may occur. Long-term side effects depend on the specific drugs received and whether you received other treatments such as radiation therapy. Follow-up care after all treatment is finished is an essential component of cancer care for all cancer survivors.

**Permanent organ damage:** Certain chemotherapy drugs may permanently damage the body’s organs. If the damage is detected during treatment, the drug will be stopped, but some side effects may remain. Damage to some
organs and systems, such as the reproductive system, may not show up until after chemotherapy is finished.

*Nerve damage:* Nervous system changes can develop months or years after treatment (see sections on nervous system and cognitive changes, page 41).

*Another cancer:* Development of a second cancer is a great concern for cancer survivors. Secondary cancers can include *Hodgkin’s disease* and *non-Hodgkin’s lymphoma, leukemias,* and some solid tumors.
Chapter 5
Advances in Management

RAYMOND F.—During the 48 treatments of vinorelbine, I had no serious side effects. The crackling in my chest and lung was still there, along with the cough and phlegm. Docetaxel was the next chemotherapy treatment. I lost my hair and fingernails and had very dry skin. After 12 treatments and very little progress, a new drug was prescribed. Gefitinib proved to be a “wonder” drug for me. After the second pill, my cough and phlegm subsided, allowing me to rest lying down in all positions. As time passed, the symptoms started acting up again and x-rays indicated that after 16 months it was time to change treatments. I had 37 treatments of gemcitabine with no side effects. My overall reaction to the chemotherapy along with the chest x-rays indicate continued stability of my lung cancer.

At the beginning of my chemotherapy treatments, my oncologist stated that he could not promise complete recovery but quality of life was our goal. As the treatment schedule continued, my raspy voice was clearing, cough and phlegm were subsiding. Lying down was comfortable and breathing was easier. After nearly 5 years, I have regained my quality of life.

—Raymond F.

Those currently being investigated include immunotherapy, a treatment that stops the formation of new blood vessels (angiogenesis), and substances that interfere with growth factor action (signal transduction inhibitors). Growth factors speed up the growth and division of cancer cells. Blocking these could slow down the growth of the cancer. Two drugs, gefitinib and erlotinib, have been approved as a single-agent treatment for patients with advanced non–small-cell lung cancer that has continued to progress despite
treatment with certain chemotherapy drugs. About 10% of these patients have shown responses to these new drugs, with about 40% demonstrating disease stabilization.

Studies are testing the best ways to combine chemotherapy with radiation therapy.

Researchers are looking at ways to alter lung cancer cells by adding extra DNA so that the patient’s immune system can spot and attack them. DNA is also being used to repair the gene changes thought to cause the cell’s original change into a cancer cell.

**CLINICAL TRIALS**

If you want to continue active anticancer treatment, you might think about participating in a clinical trial of new chemotherapy drugs. Over the past 20 years, advances in cancer treatment have been established through clinical trials. A clinical trial is a carefully planned scientific study that helps doctors develop safe, effective ways to treat cancer. Clinical trials are only conducted when there is some reason to believe that the treatment being studied may be valuable to the patient. Treatments used in clinical trials are often found to have real benefits. Most clinical trials are sponsored by government agencies such as the National Cancer Institute and pharmaceutical or biotechnology companies.

If you are interested in clinical trials, ask your doctors and nurses about your possible participation. Find out as many details as possible. If you are eligible for a study, you will be asked to read and sign

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**Case History #5**

A nonsmoker, Raymond F. was in good health until age 73 when he developed a chronic cough and a “rattle” in his chest. He was given antibiotics, which did not help. Following a chest x-ray that showed an infiltrate in the left lung base, he was treated for a possible pneumonia, but again, antibiotics did not help. A CT scan demonstrated a large infiltrative process in his left lung with a mass in the upper part of his lung and infiltrative mass along the left chest wall. A needle biopsy revealed a well-differentiated adenocarcinoma. There was also suspicion for bronchoalveolar carcinoma. Mr. F. was doing well and had stable disease following treatment with four chemotherapy drugs, each given separately for 3 or more months: vinorelbine, docetaxel, gefitinib, and gemcitabine.
a form indicating you are aware of the possible risks and are willing to participate in the study. This process is known as giving your informed consent. Even after signing the form and after the clinical trial begins, you are free to leave the study at any time, for any reason. Taking part in the study will not prevent you from getting other medical care you may need.

If you are in a clinical trial, you will receive excellent care. A team of experts will monitor your progress very carefully. No one involved in the study knows in advance whether the treatment will work or exactly what side effects will occur. That is what the study is designed to discover. Clinical trials carry risks, but so do standard treatments.

There are three types of clinical trials:

**Phase I clinical trials:** The purpose of a phase I study with a new drug is to find the best way to give a new treatment and how much of it can be given safely. The treatment has been well tested in laboratory and animal studies, but the side effects in patients are not completely known. Doctors conducting the clinical trial will start by giving very low doses of the drug to the first patients treated in the trial and increasing the dose for later groups of patients.

Your health-care team can help you decide whether a clinical trial is right for you.
“People would ask: ‘How did you get lung cancer since you did not smoke?’”

until side effects appear. Although doctors are hoping to help patients, the main purpose of such a phase I study is to test the safety of the drug.

**Phase II clinical trials:** These are designed to see if the drug works. Patients are given the highest dose that does not cause severe side effects (determined from the phase I study). Patients are then closely observed for effects on the cancer as well as side effects.

**Phase III clinical trials:** Phase III studies involve large numbers of patients. Some clinical trials may enroll thousands of patients. One group (the control group) will receive the standard (most accepted) treatment. The other groups will receive the new treatment. Each trial generally only looks at one new treatment to see if it works better than the standard treatment, but sometimes two or three treatments are tested. The study will be stopped if the side effects of the new treatment are too severe or if one group has had much better results than the others.
Chapter 6:
Living With Lung Cancer

Research/knowledge is the best approach you can have for your family to make the best decision on the course of treatment for your loved one. Keep in mind that quality of life is the most important thing because everybody is different and so is their cancer. Keeping a positive mental attitude will help with your fears in this long battle for survival. Remember there will be bad days, but if you realize that the good days will come back, you can make the best of this time.

—Daughter of Al Z.

FOLLOW-UP AND RECURRENCE

Follow-up care is important after treatment. Your health-care team will explain what tests you need and how often they should be done. Make a special effort to keep all appointments with your cancer care team and follow their instructions carefully. The health-care team will determine which tests should be done and how often, based on the type of lung cancer, its stage at diagnosis, and its response to treatment.
It is important for you to report any new or recurring symptoms to your doctor right away so that any problems related to a recurrent cancer or side effects of treatment can be dealt with promptly. These symptoms could include:

- a cough that does not go away
- chest pain, often made worse by deep breathing
- hoarseness
- weight loss and loss of appetite
- bloody or rust-colored sputum (spit or phlegm)
- shortness of breath
- recurring infections such as bronchitis and pneumonia
- new onset of wheezing

When lung cancer spreads to distant organs, it may cause the following:

- bone pain
- weakness or numbness of the arms or legs
- dizziness
- yellow coloring of the skin and eyes (jaundice)
- masses near the surface of the body, caused by cancer spreading to the skin or to lymph nodes in the neck or above the collarbone

These problems are often caused by something other than cancer. But if lung cancer is found, prompt treatment could relieve symptoms and extend your life.

“My children have stepped in and helped out a lot. Taking time off from their families and work has meant a lot to me.”

SUPPORTIVE CARE

Your body is unique, and so are your emotional needs and your personal circumstances. In some ways, your cancer is like no one else’s. No one can predict precisely how you will respond to cancer or its treatment. Statistics can paint an overall picture, but you may have special strengths such as a healthy immune system, a history of good nutrition, a strong family support system, or a deep spiritual faith. All of these have an effect on how you cope with cancer.
If you are being treated for cancer, be aware of the battle that is going on in your body. Radiation therapy and chemotherapy add to the fatigue caused by the disease itself. Rest as much as you need.

Cancer that grows around certain nerves may cause severe pain that cannot always be relieved with pain medicine alone. Sometimes radiation therapy will help. It is important that you talk to your doctor about appropriate pain relief.

Do as much as you can to help yourself stay healthy and active. If you smoke, quit. Quitting helps improve your appetite and overall health and can reduce your chance of developing a new cancer. Ask your health-care team for suggestions on how to quit.

Eat a balanced diet of healthy foods, including plenty of fruits, vegetables, and whole grains. Once you get your strength back, try to exercise a few hours each week. Your health-care team can suggest the types of exercise that are right for you.

A cancer diagnosis and its treatment are major life challenges that affect you and everyone who cares for you. Before you get to the point where you feel overwhelmed, consider attending a meeting of a local support group. There are many groups available that provide emotional support, friendship, and understanding. Your health-care team can suggest other organizations that might help you during your recovery from treatment. Some of these groups are listed on page 52.
Additional Information About Lung Cancer

Patients can benefit from having the most reliable, up-to-date resources. An educated patient is an empowered patient. There are many educational and supportive resources available to help patients understand and cope with their disease.

**Alliance for Lung Cancer Advocacy, Support and Education (ALCASE)**
800-298-2436
http://www.lungcanceralliance.org

**American Cancer Society**
800-227-2345
http://www.cancer.org

**American Lung Association**
800-586-4872
http://www.lungusa.org

**CancerCare, Inc**
800-813-4673
http://www.cancercare.org

**CancerEducation.com**
203-571-1890
http://www.cancereducation.com

**CancerFacts.com**
877-422-3228
http://www.cancerfacts.com

**Cancer Information Service**
800-422-6237
http://cis.nci.nih.gov

**Cancer.net**
703-797-1914
http://www.cancer.net

**CancerNetwork.com**
http://www.cancernetwork.com

**CancerSource.com**
800-422-6237
http://www.cancersource.com

**LivingWithIt.org**
800-981-2491
http://www.livingwithit.org

**Lung Cancer Online**
http://lungcanceronline.org

**LungCancer.org**
800-813-4673
http://lungcancer.org

**National Cancer Institute**
800-422-6237
http://www.cancer.gov

**OncoLink**
http://oncolink.com

**Oncology Tools**
http://www.fda.gov/cder/cancer
Appendix

Non–Small-Cell Lung Cancer T Stages

**Tis:** Cancer is found only in the layer of cells lining the air passages. It has not invaded other lung tissues. This stage is also known as *carcinoma in situ*.

**T1:** The cancer is no larger than 3 cm (slightly less than 1¼ inches), has not spread to the membranes that surround the lungs (*visceral pleura*), and does not affect the main branches of the *bronchi*.

**T2:** The cancer has one or more of the following features:
- Is larger than 3 cm.
- Involves a main bronchus, but is not closer than 2 cm (about ¾ inch) to the point where the *trachea* branches into the left and right main bronchi.
- Has spread to the membranes that surround the lungs.
- May partially clog the airways, has not caused the entire lung to collapse or pneumonia to develop.

**T3:** The cancer has one or more of the following features:
- Spread to the chest wall, the breathing muscle that separates the chest from the abdomen (*diaphragm*), the membranes surrounding the space between the two lungs (*mediastinal pleura*), or membranes of the sac surrounding the heart (*parietal pericardium*).
- Invades a main bronchus and is closer than 2 cm (about ¾ inch) to where the *trachea* branches into the left and right main bronchi, but does not affect this area.
- Has grown into the airways enough to cause an entire lung to collapse or to cause pneumonia in the entire lung.

**T4:** The cancer has one or more of the following features:
- Spread to the space behind the chest bone and in front of the heart (*mediastinum*), the heart, the *trachea*, the *esophagus* (tube connecting the throat to the stomach), the backbone, or the point where the *trachea* branches into the left and right main bronchi.
- Two or more separate tumor nodules are present in the same lobe.
- There is fluid containing cancer cells in the space surrounding the lung.
Non–Small-Cell Lung Cancer N Stages

**N0:** No spread to lymph nodes.

**N1:** Spread to lymph nodes within the lung and/or located around the area where the bronchus enters the lung (*hilar lymph nodes*). Metastases affect lymph nodes only on the same side as the cancerous lung.

**N2:** Spread to lymph nodes around the point where the windpipe branches into the left and right bronchi or to lymph nodes in the space behind the chest bone and in front of the heart (*mediastinum*). Affected lymph nodes are on the same side of the cancerous lung.

**N3:** Spread to lymph nodes near the collarbone on either side, to *hilar* or *mediastinal lymph nodes* on the side opposite the cancerous lung.

Non–Small-Cell Lung Cancer M Stages

**M0:** No spread to distant organs or areas. Sites considered distant include other lobes of the lungs, lymph nodes further than those mentioned in N stages, and other organs or tissues such as the liver, bones, or brain.

**M1:** The cancer has spread distantly.

Glossary

**Absolute neutrophil count (ANC)**: Calculated to determine the likelihood of developing an infection. Someone with an ANC of 1,000 or less is considered to be *neutropenic* and at risk of developing an infection. An ANC lower than 500 is considered severe neutropenia.

**Adenocarcinoma**: A type of lung cancer usually found in the outer region of the lung.

**Adjuvant chemotherapy**: Additional chemotherapy.

**Alveoli**: Tiny air sacs at the end of the bronchioles.

**Anemia**: Insufficient number of red blood cells.

**Angiogenesis**: The formation of new blood vessels.

**Angioplasty**: A procedure performed to reduce or eliminate blockage in coronary arteries. The technique uses an angioplasty balloon.

**Anorexia**: Decrease in or loss of appetite.

**Anticipatory vomiting**: A bad experience that prompted nausea and vomiting in the past causes nausea and vomiting in similar situations (for example, before receiving the next chemotherapy treatments).

**Asbestos**: A common form of magnesium silicate that was used in various construction products due to its stability and resistance to fire.

**Benign**: Not cancerous.

**Berylliosis**: Lung disease caused by breathing in beryllium, a metallic element in the mineral beryl.

**Biopsy**: A sample of cells is removed from the tumor and examined under a microscope to look for precancerous or cancerous cells.

**Bone marrow**: The tissue inside some bones that produces white blood cells (WBCs), red blood cells (RBCs), and blood platelets.

**Bone marrow suppression**: Damage to the bone marrow tissue, one of the most common side effects of chemotherapy. Also called *myelosuppression*.

**Bone scans**: For a bone scan, a small amount of radioactive substance is injected into a vein and traced to see if it builds up in areas of bone that may be abnormal because of cancer metastasis or other bone diseases.
**Brachytherapy**: The placement of radioactive “seeds” into the lung at the area of the tumor.

**Bronchi**: The two large tubes that branch off from the *trachea* and bring air down into the lungs.

**Bronchioalveolar carcinoma**: A type of non–small-cell lung cancer that appears in the outer regions of the lung and is common in nonsmokers.

**Bronchioles**: Smaller branches of the airways of the lungs.

**Bronchoscopy**: A flexible fiberoptic tube is passed through your nose into the bronchi (after you are given a mild sedative) to help find tumors or blockages in the lungs and take samples of tissue or secretions to be examined under a microscope for cancerous or precancerous cells.

**Cachexia**: Severe *anorexia*; a form of malnutrition.

**Carcinogen**: Cancer-causing agent.

**Carcinoma in situ**: For lung cancer this means cancer is found only in the layer of cells lining the air passages. It has not invaded other lung tissues.

**Central nervous system**: Brain and spinal cord.

**Chemotherapy**: Treatment of disease by means of chemical substances or drugs.

**Chest x-ray**: A test to look for any mass or spot on the lungs.

**Clinical trial**: A carefully planned scientific study that helps doctors develop safe, effective ways to treat cancer.

**Colony-stimulating factors**: Drugs that build up the blood cell count.

**Clinical trial**: A carefully planned scientific study that helps develop safe, effective ways to treat cancer.

**Computed tomography (CT)**: An x-ray procedure that produces detailed cross-sectional images of your body. Also called *computerized axial tomography (CAT) scan* and *computed tomography (CT scan)*.

**Complete blood count (CBC)**: Blood test to determine whether your blood has the correct number of various cell types.

**Constipation**: The passage (usually with discomfort) of infrequent, hard, dry stool.

**Cranial nerves**: Connected directly to the brain, these nerves are important for movement and touch sensations of the head, face, and neck. Cranial nerves are also important for vision, hearing, taste, and smell.
CT scan: See computed tomography above.

Diaphragm: Breathing muscle that separates the chest from the abdomen.

Diarrhea: The passage of loose or watery stools three or more times a day with or without discomfort.

Duodenum: The first section of the small intestine.

Echocardiogram: A record obtained by the use of ultrasound in the investigation of the heart and blood vessels.

Electrocardiogram (ECG): A simple test that traces the electrical activity of your heart. Also known as an EKG.

Ecchymoses: Large bruises.

Endoscopic photodynamic therapy: Kills cancer cells by sensitizing them with an injected chemical and then activating the chemical by shining a bright light directly on the cancer.

Environmental tobacco smoke: Tobacco smoke that you breathe in but that comes from cigarettes, cigars, or pipes smoked by other people.

Epidermal growth factor receptor: A growth-regulating protein present on the surface of many lung cancer cells.

Erythropoietic agents: Substances that stimulate RBC production by bone marrow cells and can relieve symptoms of anemia and reduce the need for blood transfusions.

Esophagitis: Inflammation and sores in the esophagus that may result from chemotherapy.

Esophagus: The portion of the digestive canal between the throat and stomach.

Excision repair cross-complementing (ERCC)-1 markers: Used to assist doctors in choosing the correct cytotoxic therapy in the treatment of advanced NSCLC.

External beam radiation: A form of radiation therapy in which the radiation is delivered by a machine pointed at the area to be radiated.

Flavonoids: Substances found in fruits, vegetables, and green tea that may help protect you from lung cancer.

Fluoroscopy: An imaging procedure, which is like an x-ray, but the image is viewed on a screen rather than on film.
Gene therapy: An approach to preventing and/or treating disease by replacing, removing, or introducing genes or otherwise manipulating genetic material.

Genetic predisposition: Susceptibility to a disease that is related to a gene mutation, which may or may not result in actual development of the disease.

Hematocrit: The percentage of total blood volume occupied by red blood cells. Its normal range is between 37% and 52%.

Hemoglobin: The red pigment in red blood cells that carries oxygen.

Hemorrhoids: Swollen but normally present blood vessels in and around the anus and lower rectum that stretch under pressure.

Hilar: Refers to the area where nerves and blood vessels attach to an organ.

Hodgkin’s disease: A type of cancer of the lymphatic system.

Immunotherapy: A treatment that activates the body’s own immune system to destroy disease.

Informed consent: A form you read and sign to indicate you agree to take part in a clinical trial and that you understand the possible risks and benefits. Even after signing the form and after the clinical trial begins, you are free to leave the study at any time, for any reason.

Jaundice: Yellowing of the skin and the whites of the eyes, a sign of liver damage.

K-ras test: Checks for the presence of the K-ras gene, which, when mutated, can lead to poor responses to EGF inhibitors.

Kidneys: Two organs in the lower back that clean waste and poisons from the blood.

Large-cell undifferentiated carcinoma: A type of non–small-cell lung cancer that can appear in any part of the lung and tends to grow and spread quickly, resulting in a poor prognosis for the patient.

Laser: The acronym for Light Amplification by Stimulated Emission of Radiation. A laser is an instrument that produces a powerful beam of light that can vaporize tissue.

Leukemia: A form of bone marrow cancer marked by an increase in white blood cells.

Leukopenia: A low white blood cell count.

Libido: The desire for sexual activity.
**Lobectomy:** Removing a lobe of the lung.

**Lymph node:** A rounded mass of lymphatic tissue that is surrounded by a capsule of connective tissue. Lymph nodes filter lymph (lymphatic fluid), and they store lymphocytes (white blood cells). They are located along lymphatic vessels. Also called a lymph gland.

**Lymphadenopathy:** Disease or swelling of the lymph nodes.

**Magnetic resonance imaging (MRI):** MRI scans use radio waves and strong magnets instead of x-rays to produce a very detailed image of parts of the body.

**Mediastinal lymph nodes:** Those along the windpipe and the major bronchial tube areas.

**Mediastinal pleura:** Membranes surrounding the space between the two lungs.

**Mediastinoscopy:** A small cut is made in your neck and a hollow lighted tube is inserted behind the sternum to take tissue samples from the mediastinal lymph nodes. The samples are then examined under a microscope to see if cancer cells are present.

**Mediastinotomy:** A surgical procedure that opens the chest cavity by cutting through the sternum or the ribs to allow the surgeon to reach and remove more lymph nodes.

**Mediastinum:** Space behind the chest bone and in front of the heart.

**Mesothelioma:** A type of cancer that starts from the pleura.

**Metastasis:** The process by which cancer cells break away from a tumor and spread to other parts of the body.

**Mucositis:** Inflammation of the lining layer of the mouth, throat, and esophagus.

**MUGA Scan:** Test that traces a radioactive substance through the heart to check for any changes in heart function.

**Myelosuppression:** Damage to the bone marrow tissue, one of the most common side effects of chemotherapy. Also called bone marrow suppression.

**Nadir:** The lowest count that blood cell levels fall to.

**Nausea:** An unpleasant wavelike sensation in the stomach and back of the throat that can lead to retching, vomiting, or both.
Needle biopsy: A needle is guided into the mass while your lungs are being viewed with CT scans or fluoroscopy, and a sample of the mass is removed and examined under a microscope.

Neutropenia: An abnormally low number of neutrophils.


Opioid: A class of drugs (eg, heroin, codeine, methadone) that are derived from the opium poppy plant, contain opium, or are produced synthetically and have opium-like effects. Opioid drugs relieve pain, dull the senses, and induce sleep.

Ovaries: The pair of female reproductive organs that produce eggs and hormones.

Palliative care: Care aimed at relieving pain and increasing comfort.

Parietal pericardium: Sac surrounding the heart.

Peripheral nerves: Leading to and from the brain to the rest of the body, these nerves are important in movement, touch sensations, and regulating activities of some internal organs.

PET scan: See positron emission tomography below.

Petechiae: Multiple small bruises.

Pharyngitis: Inflammation and sores in the throat that may result from chemotherapy.

Phlegm: Thick mucus secreted in the respiratory passages.

Pleura: The layer of cells that line the outer surface of the lung.

Pleural effusion: Accumulation of fluid around the lungs.

Pleural membranes: The delicate membranes that cover the lungs.

Pneumonectomy: Removal of an entire lobe of the lung.

Positron emission tomography (PET): Positron emission tomography (PET) uses glucose (a form of sugar) that contains a radioactive atom and a special camera detects the radioactivity to test for lung cancer.

Prognosis: The outlook for chances of survival.

Prophylactic cranial irradiation (PCI): Radiation therapy to the brain to try to prevent metastasis.
**Radon:** A radioactive gas, which cannot be seen, tasted, or smelled, but which in concentrated forms can be a possible risk factor for lung cancer.

**Radiation therapy:** Treatment with high-energy rays (such as x-rays or gamma rays) to kill cancer cells.

**Radiocontrast agent:** A substance such as barium that is administered internally and will look different from soft tissue on radiographic exams, such as computed tomography and magnetic resonance imaging.

**Remission:** Complete or partial disappearance of the signs and symptoms of disease in response to treatment.

**Risk factor:** Anything that raises the chances of a person developing a disease.

**Secondhand smoke:** Tobacco smoke that you breathe in but that comes from cigarettes, cigars, or pipes smoked by other people.

**Segmentectomy:** Surgical removal of defined segments.

**Signal transduction inhibitors:** Substances that interfere with growth factor action.

**Silicosis:** Lung disease caused by breathing in the chemical element silicon.

**Sputum cytology:** A sample of *phlegm* is examined under a microscope to see if cancer cells are present.

**Squamous cell carcinoma:** A type of non–small-cell lung cancer usually linked to a history of smoking and often found centrally, near the bronchi.

**Staging:** System to describe how localized or widespread your cancer is.

**Stent:** A device implanted in a vessel used to help keep it open.

**Sternum:** Breastbone.

**Stomatitis:** Inflammation and sores in the mouth that may result from chemotherapy.

**Supportive care:** Care given to improve the quality of life of patients who have a serious or life-threatening disease.

**Surgery:** Procedure to remove or repair a part of the body or to find out if disease is present.

**Testosterone:** The hormone responsible for development of male sexual characteristics.

**Thrombocytopenia:** Low platelet count.
**Thoracentesis:** A needle is placed between the ribs to drain a fluid accumulation around the lungs, which is checked under a microscope to look for cancer cells. If cells are malignant, thoracentesis may be repeated to remove more fluid, which can help the patient breathe better.

**Thoracoscopy:** A procedure that uses a thin, lighted tube connected to a video camera and monitor to view the space between the lungs and the chest wall.

**Tinnitus:** Ringing in the ears.

**TNM staging system:** The system, also known as the American Joint Committee on Cancer (AJCC) system, used to describe the growth and spread of non–small-cell lung cancer, in which: T stands for tumor (its size and how far it has spread within the lung and to nearby organs); N stands for spread to lymph nodes; and M is for metastasis (spread to distant organs).

**Trachea:** Windpipe.

**Tumor:** An abnormal mass of tissue.

**Ureters:** Tubes that carry urine from the kidneys to the bladder.

**Visceral pleura:** Membranes that surround the lungs.

**Vomiting:** A process controlled by the vomiting center that causes the contents of the stomach to be forced out through the mouth.

**Wedge resection:** Surgical removal of small wedges.
Comfort and Wisdom From People Living With Lung Cancer

- Talk to other patients with cancer. Recognize that there are others also fighting and beating this awful disease. This strategy helped me to cope; just knowing that I’m not alone makes me think that there is hope for me too.

- During your doctor visits, always ask questions; if you don’t understand take a friend or family member with you, take notes, and ask the questions later. Your doctor wants you to understand and know exactly what is going on.

- Accept any help from others when they offer. Remember, people don’t offer to help if they really don’t want to do it. Don’t let your pride get in the way.

- There are times when you don’t feel like or are unable to do the simplest things like getting dressed, cleaning, cooking, or even folding clothes. Keep a positive attitude. There will be times when you feel discouraged and depressed. This is when praying, visiting with a friend, making a phone call, or reading helps.

- I would tell anyone in my situation to pray, and pray a lot. Find a doctor who you feel comfortable with, who is knowledgeable in the newest cancer research. If there is a new treatment or procedure your health-care team recommends, try it. You may be helping the research that may save someone else’s life.

- Check with cancer support groups. Maintain a positive attitude and be patient. Be as active as your body allows.

- You must fight to beat cancer.

- Tell the ones you love that you love them.
References


