Chapter 1

The 4-1-1 on Cancer

In This Chapter

- Getting clear on cancer basics
- Dealing with your diagnosis
- Looking at the various types of cancer
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- Getting a handle on cancer staging

Everyone knows someone who's had cancer. In the United States, approximately one in two men and one in three women will develop some form of cancer during their lifetimes. But cancer isn't one disease — it's actually a wide spectrum of diseases, ranging from conditions that can be easily managed with surgery to illnesses that require extensive treatments, including surgery, radiation, and chemotherapy.

So, what exactly is cancer? How does it develop? Why are some cancers cured, but others progress despite the best available treatment? Why are some cancers found early, when they're confined to one specific region of the body, while others aren't found until they're widespread?

If you or your loved one received a cancer diagnosis, these questions were probably rolling around in your head at some point. In this chapter, we answer some of these important, yet often complex, questions so that you understand what a cancer diagnosis really means.

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A Primer on the "Big C"

Ever have a symptom and go online to see what it may be? We've all done it, and no possibility of what that symptom might indicate instills more fear than the word *cancer.* After the diagnosis is made, you have an even greater thirst for information. Being educated about your disease is essential. Studies indicate that educated patients are more compliant with their treatments and have better outcomes, which is what you want! But to have real knowledge, you need to be able to distinguish fact from fiction — and with cancer,

there's a lot of fiction out there. So, in this section, we give you a quick overview of cancer, answering the key questions, so that you're truly educated about your disease and the cancer landscape you'll be traversing.

What is cancer?

In the early development of our understanding of cancer, most researchers thought that it resulted from cells no longer being under the control of normal growth factors and immune regulation, causing them to suddenly grow wildly. If the cancer couldn't be removed completely with surgery, it would spread and cause the patient to die. Although this explanation does appear to describe the course of *some* malignancies, the scientific and medical communities now know that cancer is actually a far more complex and remarkably diverse group of medical conditions. In fact, even two seemingly similar cancers — like two breast cancers or two colorectal cancers — may actually be quite different, causing them to respond differently to the same treatments.

As a result, we can't describe every type of cancer in this book — that would be akin to trying to describe every snowflake that falls from the sky. So, for our purposes, it's fair to simplify things by saying that cancer is characterized by the growth of abnormal cells, their invasion into surrounding tissue, and, ultimately, their spread to other regions of the body if not caught early enough. This process occurs because these abnormal cells (also called *cancerous cells* or *malignant cells*) have somehow lost their ability to appropriately respond to the extensive network of highly complex regulatory mechanisms whose primary purpose is to ensure the normal functioning of the particular tissue. (For more on the definition of *malignant,* see the nearby sidebar, "Building your cancer vocabulary.")

How does cancer develop?

Cancer is caused by changes in a cell's DNA (its genetic blueprint), leading to cellular mutations. Some of these mutations may be genetic (inherited from our parents), while others may be caused by exposure to *carcinogens* (cancer-causing substances). But although all cancers are caused by mutations, not all mutations cause cancer. Mutations within genes of normal cells occur quite regularly, particularly when cells divide to increase their numbers, and most mutations are harmless. The increase in the number of cells in a given tissue may be due to any of the following:

- **The normal process of growth of the individual:** This kind of cell division occurs during childhood.
- **As part of the repair of damaged tissue:** When you have a cut on your hand or surgery for a broken leg, cells divide to repair the tissue that was damaged.

- **As a component of the body's strategy to successfully combat external threats:** For example, there is an increase in immune cells after infection by bacteria or a virus, or the body is exposed to carcinogens that cause mutations, affect hormone levels, or impair the immune response.

Building your cancer vocabulary

If you find that your oncologist or anyone else on your treatment team is using words that you don't understand, ask for clarification and be sure to write it down. When you get home, you can look up that word online and familiarize yourself with what it means.

It would be impossible for us to outline all the cancer terms you'll be encountering. We'd need volumes for that, and you don't need us to provide you with a dictionary anyway. But what we can provide you with is some of the terminology that you may encounter with regard to your tumor:

- ***Benign* versus *malignant:*** A *benign* tumor is a mass that grows locally, does not invade surrounding tissue, and, in most cases, doesn't spread to distant sites. Such tumors may also be referred to as *noncancerous* or *nonmalignant*. In contrast, *malignant* tumors can invade surrounding normal tissue and spread to distant sites.

  Although most people are relieved when they hear that their tumor is benign, depending on its location, benign tumors can still cause considerable harm. For example, a benign tumor in the brain may destroy normal tissue as it grows. In contrast, some malignant tumors may be easily removed through surgical excision and require no further treatment, such as in many cases of basal cell carcinoma of the skin. So, as you can see, *benign* and *malignant* can be relative terms.

  However, in most circumstances, benign tumors can be removed surgically and don't require subsequent external radiation, and there is no role for chemotherapy when it comes to these tumors.

- ***Noninvasive* and *locally invasive* versus *metastatic:*** *Noninvasive tumors* are generally considered superficial cancers because the tumor cells haven't spread into the surrounding tissue, whereas *locally invasive* cancer has spread beyond the confines of its own tissue space and directly into the surrounding tissues where it's not normally present. *Metastatic* cancer means the cancer has spread to sites beyond its tissue of origin. This may be to local lymph nodes or to distant organs. The method of spread may be by growth of the cancer into surrounding organs or spread to the lymph nodes or the blood.

- ***Primary tumor* versus *secondary tumor:*** *Primary tumor* refers to what is believed to be the initial site of the malignancy, while *secondary tumor* or *metastatic site(s)* refers to locations where the tumor may have spread.

  It may not always be easy to distinguish between the primary and secondary tumor sites. This is particularly the case when the cancer is found in multiple sites at diagnosis and one of a number of locations might have been the "primary site." In general, in this situation, the most important reason to know the primary site is to determine the most effective treatment program.

The complex system of normal regulatory mechanisms present within all of us allows for necessary cellular growth. When the required task has been completed, that same system slows the growth rate. This process occurs in every tissue in the body and is constantly in operation. Unfortunately, in some people, this complex regulatory system fails to keep this growth and spread in complete check, and a cancerous growth develops.

All cancers have some degree of genetic abnormality compared with the corresponding normal tissue. In some situations, there may be a single well-defined event that led to the cancer, but most often there are large numbers of changes from the normal condition, frequently making it very difficult to know which specific mutation or alteration is actually responsible for the initial development of the malignancy or driving its progression. Most cancers require a number of specific events to occur before a given cell becomes malignant.

Therefore, the body may actually have a number of opportunities to control the cancer before it becomes widespread in the body, and this is also why cancer screenings are so important. When regular cancer screenings are undertaken, a cancer may be detected before it has acquired the ability to invade surrounding tissue or spread throughout the body.

Genetic abnormalities develop over a long period of time, usually years or even decades. So, although it may feel like your cancer started and progressed quite suddenly, depending on your tumor, this process may have been going on for many years.

Why aren't all cancers created equal?

You can better appreciate the tremendous variation in the rate of development, growth, and spread of cancer when you consider

- The remarkable complexity of the genetic background of individual cancers
- The differences in an individual patient's own biological mechanism that attempts to respond to the presence of the cancer (which may include various immune mechanisms or changes in growth factors that may still influence the rate of tumor growth and spread even after the malignancy has been established)

Certain cancers, by their very nature, are widespread at diagnosis (such as blood cancers), while others are more easily detected because they can be directly observed by the individual (such as skin cancers), by a physical examination (such as breast cancer), by imaging procedures (such as breast and lung cancers), or by blood tests (such as prostate cancer).

In addition, some cancers appear to maintain some degree of the normal mechanisms of control and are, in general, more likely to progress slowly,

whereas other cancers appear to have lost all ability to respond to any normal control mechanisms. Examination of the actual cancer tissue under the microscope can often provide a clue to the anticipated prognosis of a given cancer. Tumors that are described as being *well-differentiated* or *low-grade* appear (under the microscope) to have characteristics of a malignancy, but they also continue to have features that are similar to the normal cells in that particular tissue. Conversely, cancers that are described as being *poorly differentiated, undifferentiated,* or *high-grade* are likely to have a more aggressive clinical course. Again, the thought here is that the body's normal regulatory mechanisms are less able to impact the progress of the cancer in the poorly differentiated state.

Other factors that are likely to influence the behavior of your cancer include

- **Your age:** As you age, you have more of the other risk factors for cancer, you've been exposed to possible carcinogens for longer, and your cellular repair mechanisms are likely to be less effective.
- **Any underlying immune deficiency problems:** Immune problems can compromise your body's ability to control the cancer's spread.
- **Your underlying nutritional state:** Nutritional deficiencies can impair immunological and other essential internal regulatory strategies.

Which factors increase the risk of cancer?

When it comes to cancer, a *risk factor* is a feature present within an individual that is associated with a statistically greater risk for the development of the disease, but is itself not necessarily the cause of the disease. For example, it has been shown that women who are obese have an increased risk of breast cancer. The weight itself likely isn't the *cause* of the cancer; instead, it's the fact that these women have higher levels of estrogen bathing the normal breast tissue, which, over a period of many years, may increase the potential for the development of breast cancer.

In the following sections, we cover the major risk factors for cancer.

Smoking

Without any possible question, the single most important risk factor for the development of cancer is tobacco exposure. Research has shown that tobacco contains thousands of different chemicals, and more than 40 of these chemicals have been documented to be possible carcinogens.

Although cigarette smoking is the major cause of lung cancer (the single most deadly cancer in both men and women) and cancers in the head and neck regions, it's also a major risk factor for the development of cancers of the esophagus, stomach, pancreas, colon, liver, kidney, bladder, and cervix. In addition, exposure to secondhand smoke, resulting from regular close

contact with a smoker, has been estimated to result in more than 3,000 cancer deaths in the United States each year.

Nutrition

Another major risk factor is nutrition. As many as one-third of all cancers in the United States are thought to be related to a nutritional factor, which may include obesity, poor diet, and lack of adequate physical activity. Cancers that have been most strongly correlated with obesity include malignancies of the uterus, breast (in postmenopausal women), colon, esophagus, kidney, and gallbladder. Other sites where existing data are not quite as compelling regarding obesity as a risk factor include blood cancers and malignancies of the liver, pancreas, and stomach.

Alcohol

Excessive alcohol consumption has been identified to be a major risk factor for the development of cancers in the head and neck region, liver, esophagus, and breast.

Infectious diseases

Exposure to particular infectious diseases has also been shown to be a highly relevant risk factor for certain malignant conditions.

Studies have unequivocally shown that essentially all cervical cancers develop following exposure to, and persistence of, human papillomavirus (HPV). HPV has also been linked to *oropharyngeal cancer* (cancer of the head and neck), whereas the hepatitis virus is a major cause of liver cancer. Additional viruses known to be associated with the development of cancer include the human immunodeficiency virus (HIV) and *Helicobacter pylori,* an important cause of stomach cancer and a particular type of lymphoma.

Other risk factors

Other recognized cancer risk factors include

- Exposure to ionizing radiation — either intentional (for therapeutic or diagnostic purposes) or accidental exposure (such as from radon gas; see Chapter 17)
- Certain medications, including chemotherapy drugs
- Exposure to chemicals

What does cancer feel like?

Providing a simple characterization of what your cancer may feel like when it develops and progresses is difficult.

Some cancers can present quite dramatically due to their location in the body or can impact normal body function. For example, if you have a large colon cancer, it may cause an obstruction of the bowel, resulting in pain or an inability to have a normal bowel movement. If you have acute leukemia, you may have a high fever (due to infection and a very low concentration of normal white blood cells capable of fighting the infection) or spontaneous bleeding or bruising (due to a very low level of *platelets,* which are the cells responsible for preventing this process).

Conversely, your cancer may initially cause no symptoms and you may discover it by chance, such as by feeling an abnormal lump or mass under the skin while bathing. Or it may be found on a routine screening test, such as through a Pap smear, mammogram, or prostate-specific antigen (PSA) test.

Some cancers that result in absolutely no symptoms in their early stages may cause modest or even severe symptoms if detected later during their course. For example, if prostate cancer is found early through screening, you may have no or only minor urinary symptoms, but if it's found at a late stage, you may have considerable bone pain if the cancer has spread to your bones.

Most symptoms are not specific to cancer (as anyone who's spent any time looking up symptoms on WebMD can tell you). For example, if you have severe abdominal pain, it may be colon cancer or another cancer, but it may also be due to another serious medical condition (such as appendicitis or diverticulitis) or possibly something less serious (like severe constipation). And even if a cancer is ultimately discovered, the particular symptoms may not be helpful in defining the specific type of cancer. For example, abdominal pain may be caused by cancers of the colon, stomach, liver, ovary, uterus, pancreas, and other malignancies that may have spread to this location (such as breast cancer). Finally, no matter what your symptoms, they aren't necessarily indicative of your prognosis.

Coming to Terms with Your Diagnosis

When you received your cancer diagnosis, it may have felt like the end of the world, or maybe you found yourself living in a haze for a while. Perhaps you had nightmares about it, only to find that when you woke up, the nightmare wasn't over. Coming to terms with a cancer diagnosis takes time. Your mind has a lot to process, so you'll feel many things: fear, anxiety, hopelessness, sadness. If your prognosis is good and there's a good chance for a cure, then these emotions may not be as severe, but if your prognosis is uncertain or appears poor, these feelings may be magnified.

In this section, we examine the emotional side of a cancer diagnosis and how to deal with your emotions and telling your loved ones. We also look at where you can find additional emotional support and how to get yourself prepared for what lies ahead.

Processing your emotions

We can't overstate the profound impact the word *cancer* has, particularly when you're on the receiving end of the diagnosis. But despite the natural fear generated by this diagnosis, most people with cancer today will, in fact, be *cured* of their illness. Cancer is no longer the death sentence it once was, and, for some, the diagnosis brings a whole new meaning to life.

The process of cancer management is a journey, with the diagnosis only being the first stop. You'll experience a whole range of emotions as you work toward recovery. That's completely natural. But regardless of where you are and any frustrations and setbacks you may encounter along the way, trying to remain optimistic is important, even if your prognosis doesn't seem favorable. Remember that no one comes with an expiration date! And some evidence suggests that optimism can be an important key to good outcomes.

And there's good reason to be optimistic. These days, treatment can be highly successful in relieving and preventing symptoms, improving overall quality of life, substantially extending survival, and, in many settings, actually eliminating the disease. In fact, the very term *survivorship* has been developed to describe the process of recuperation. The idea is that you begin this journey the day the diagnosis is made and continue to concentrate your personal efforts on the goal of survival, whether you're ultimately cured or you end up living with your cancer.

With all the treatments these days, even if you can't be cured, chances are good that there's a treatment that can extend your life for many years to come. Plus, new treatments are constantly under investigation and being approved. So, there's considerable hope when you find yourself duking it out in the cancer arena.

Now, we're not saying you should be happy about having cancer or feel good about it. We're also not saying the road will be easy. Under some conditions, it may be very difficult — perhaps the greatest challenge you've ever faced. It's okay for you to cry and be angry. Letting out those emotions is better than keeping them bottled up inside. But it's also critical not to let your emotions impede your ability to progress down the cancer treatment road.

Telling family and friends

Informing your family and friends that you have cancer isn't easy, particularly if your suggested prognosis is less than optimal.

Saying the words may be difficult, but remember that these are the people who love and understand you most, and they want nothing more than to provide you with support. They'll understand if you need to say the words through tears, by cracking a joke, or by sounding very matter of fact. But

no matter how you tell them, the best thing you can do is be honest with them, while also letting them know what you need. Just like you, they may feel afraid, angry, and helpless. They may also be concerned about saying the wrong things. By involving them in your cancer journey and letting them know what you need, you may just strengthen the bonds with the people you're closest to.

Finding the support you need

Your family and close friends may provide you with all the support you need to get through your cancer journey. After all, they can serve as a sounding board for your diagnosis, prognosis, and experiences; help you with chores if you're too tired to do them yourself; and just provide you with love and support (for example, by holding your hand if you need it). But if this support isn't enough for you, or if you want to connect with others who already have or are currently walking the cancer road, you may want to look into support groups. Numerous options are available, from faith-based groups to cancer-specific support groups. Some support groups regularly meet in person, whereas others are web based, allowing you to connect with people through message boards, video chats, text chats, and other means. The American Cancer Society maintains a list of organizations that provide support groups at `www.cancer.org/treatment/supportprogramsservices`.

In some circumstances, you may consider seeking assistance from a medical professional, such as a psychologist, social worker, or counselor. Cancer can lead to a range of emotions, and a therapist may be able to help guide you through these emotions and provide you with new insights. If your emotions are preventing you from moving forward with treatment (for example, because you're afraid of the side effects), seeking support is especially important, because delaying treatment can lead to poor outcomes.

Your cancer center may have a therapist on staff who you could speak with. If not, your oncologist or healthcare team can point you in the right direction.

Getting prepared

There's no simple formula for preparing for the future, but obtaining as much helpful information regarding your particular cancer type and available therapeutic options is an essential first step. By being well informed, you're in the best position to work with your healthcare team to optimize your treatments.

So, where to get such information? Getting it from reputable sources is critical. Fortunately, there are many of them. First and foremost, your healthcare providers — both your primary-care doctor and specialty medical team — should be able to provide you with important information or point you in the right direction. The Internet is also increasingly serving as a vital source

of information for people with serious medical conditions, including cancer. When seeking information online, look to government sites (like the National Cancer Institute; www.cancer.gov), cancer organizations (like the American Cancer Society; www.cancer.org), professional medical organizations (like the American Society of Clinical Oncology; www.asco.org), and treatment center websites (like the Cancer Treatment Centers of America; www.cancercenter.com).

When your treatment plan is developed, take the time to understand it. Don't hesitate to ask questions. When it comes to cancer and its management, there are simply no silly or stupid questions, and don't let anyone tell you otherwise!

Understanding the Types of Cancer

As we mention at the beginning of this chapter, cancer isn't just one disease — it's actually a host of different diseases, all involving some form of abnormal cellular development. But to better classify cancer, its *primary site* (where in the body the cancer first developed) and *histological type* (type of tissue from which it originated) are considered. In this section, we look at the common types of cancer. (For more on primary tumors, see the "Building your cancer vocabulary" sidebar, earlier in this chapter.)

Carcinoma

Carcinoma refers to a group of malignant conditions whose normal tissue of origin serves as the lining cells (inner or outer surfaces) of a particular organ. These cells are known as *epithelial cells.* Carcinomas are by far the most frequent cancers seen in both men and women, and they affect common primary sites, such as the breasts, lungs, colon, prostate, and pancreas.

Surgical removal, if possible, is the primary treatment of a localized carcinoma. If your oncologist is concerned that residual local cancer may remain, you may be given radiation treatment to the region where the tumor was located. If there is no definite evidence that the cancer has spread beyond the local or regional area, but there's a risk of malignant cells having spread to other areas of the body before treatment was undertaken, chemotherapy (called *adjuvant chemotherapy*) may be given.

If surgically removing a carcinoma isn't possible because of its size or a medical condition that makes surgery dangerous (such as pre-existing severe heart disease), the cancer may be managed with external radiation. And if there is concern that the cancer may have spread beyond the local area, adjuvant chemotherapy may also be administered.

A relatively recent approach for treating several types of carcinomas (like those of the breast, head and neck, and ovaries) has been to administer chemotherapy *before* surgical treatment (called *neoadjuvant chemotherapy*). The goal here is to decrease the size of the cancer before surgery, with the specific purpose of reducing the amount of normal tissue that must be removed and potentially increasing the size of the patient population that may benefit from definitive local therapy.

Sarcoma

Compared with carcinomas, sarcomas are uncommon malignancies. In addition, they comprise a rather heterogeneous group of cancers, which are characterized by the fact that they've arisen from the middle of tissues, or the supporting cells in those tissues. Sarcomas can develop from fat, muscle, cartilage, bone, and vascular tissue.

The names of sarcomas include information regarding the cell of origin. For example, sarcomas arising from bone are called *osteosarcomas,* while sarcomas developing from fat cells are called *liposarcomas.*

The principal treatment approach is surgery, if possible. Local radiation is used if residual cancer is a concern. With the important exception of osteosarcomas, the role of chemotherapy as an adjuvant treatment or to manage metastatic sarcomas in adults is limited. (For more on the definition of *metastatic,* see the "Building your cancer vocabulary" sidebar, earlier in this chapter.) In contrast, children or young adults with sarcomas are likely to receive chemotherapy because they tend to respond very well to it.

Myeloma

Multiple myeloma is a cancer that develops in the bone marrow from a normal cell population known as *plasma cells.* Plasma cells have a critical role to play in normal antibody formation. Multiple myeloma often causes the blood and urine to contain a high concentration of an abnormal protein, which can be measured to evaluate the response of the illness to treatment.

Although multiple myeloma is uncommon (accounting for only 1 percent of all cancers), it's the second most frequently observed malignant condition developing from bone marrow cells. Multiple myeloma is frequently associated with anemia, problems with kidney function, and elevated blood calcium levels.

Over the past decade, outcomes following multiple myeloma treatment have substantially improved. Routine treatment for the malignancy includes the use of steroids, standard chemotherapy drugs, and two new drug classes

known as *immunomodulatory drugs* and *proteasome inhibitors.* External radiation may be given, particularly in the management of painful bone lesions, and bone marrow or stem cell transplantation may be used in select cases.

Leukemia

Leukemia refers to a group of cancers arising from two normal cellular populations in the bone marrow: granulocytes and lymphocytes. The major role of *granulocytes* is to prevent illness from exposure to *pathogens* (disease-causing agents) in the environment, while *lymphocytes* play a major role in *immunoregulation* (control of specific mechanisms that affect immune responses) and also help with controlling certain types of infections.

The terms *acute* and *chronic* are added to the particular cellular type of leukemia to identify how involved the most immature cell population is:

- **Acute:** Acute leukemia has a substantial percentage of such immature cells and tends to progress very rapidly if chemotherapy isn't given. In fact, acute leukemia is frequently considered a medical emergency, often requiring hospitalization and initiation of therapy within hours of the time the diagnosis is made.
- **Chronic:** Chronic leukemia has much lower percentage of immature cells and a far higher proportion of more mature cells. It tends to progress more slowly and may not cause symptoms for years.

The distinction between acute and chronic leukemias is principally based on the percentage of immature cells versus mature cells, rather than the actual number of abnormal cells found in the blood or bone marrow.

In addition to being classified as acute or chronic, leukemia may be lymphocytic/lymphoblastic or myelogenous:

- Lymphocytic/lymphoblastic leukemia affects white blood cells called *lymphocytes.*
- Myelogenous leukemia affects white blood cells called *myelocytes.*

The four main types of leukemia are acute lymphoblastic leukemia (ALL), acute myelogenous leukemia (AML), chronic lymphocytic leukemia (CLL), and chronic myelogenous leukemia (CML).

Many patients with leukemia have a low concentration of normal bone marrow cells, leading to anemia (because of reduced red blood cell counts), infection (because of a reduced number of granulocytes), and bleeding (because of reduced platelet counts). The severity of the leukemia is greatly influenced by the disease's impact on the ability of the bone marrow to make normal cells.

In the past, all leukemias were managed in a similar manner, with all patients receiving chemotherapy. There was no difference in the class of drugs used, but the intensity of treatment may have varied. However, the discovery of a specific molecular abnormality in most patients with CML and the development of new "targeted" agents, such as imatinib, directed at this abnormality have significantly improved the prognosis of this cancer. Today, most patients survive more than eight to ten years following their initial diagnosis.

In addition, most children with ALL, which is the most frequent type of leukemia in this age group, are able to be cured of their illness. Although this outcome is less common for adults with either AML or ALL, it is possible.

Lymphoma

Lymphomas are malignancies of *lymphocytes* (the cells responsible for immunoregulation and control of certain infectious organisms). Lymphomas are divided into two major categories: Hodgkin's disease and non-Hodgkin's disease.

Although lymphomas appear to originate from lymph tissue, the same cellular population can be present in the bone marrow and blood.

In some situations, the decision to classify a particular cancer as being a lymphoma versus a CLL (with excessive concentrations of mature-appearing lymphocytes present in the blood) may be based on the relative importance of blood versus tissue involvement by the process.

Making matters even more complex, lymph tissue can normally be found outside the lymph nodes. As a result, it's possible to have lymphomas arise in organs such as the stomach, bone, brain, and colon. Lymphomas that develop in one body region may also commonly spread to the bone, bone marrow, lungs, liver, and brain.

Treatment of lymphomas includes chemotherapy, radiation, immunotherapy, and bone marrow or stem cell transplantation. The prognosis depends on how widespread the disease is and how well it responds to treatment. The goal of therapy is also influenced by the specific type of lymphoma. Some forms can be cured by current therapy, whereas other subgroups may not be curable (but it may still be possible to control symptoms for an extended period of time in such cases).

Mixed types

Microscopic examination (also called *pathological review*) may reveal that a particular cancer is composed of several cellular elements. For example, a lung cancer may be found to have both a squamous cell carcinoma and an

adenocarcinoma. This may be due to the fact that a particular cancer actually develops from a very early (immature) cell population and subsequently attempts to differentiate into more mature cells involving more than one "normal" pathway. So, what's seen under the microscope is not the actual malignant cell, but the end result of this unsuccessful differentiation process. So-called *mixed tumors* are also seen in sarcomas and germ cell tumors, likely for similar reasons.

In other cases, two separate cancers are found, with one cancer being a primary lesion in the organ and the second being metastatic disease from another site. Or two apparently independent primary cancers may be found at the same time in neighboring tissues. This unusual pattern has been observed in some women, who appear to develop simultaneous cancers in both the ovaries and the uterus. This outcome is thought to result from what has been dubbed a *field defect,* with the same environmental factors interacting upon a susceptible genetic background, leading to the two organs developing malignancies in roughly the same time period.

Other types

A number of additional less common malignancies can involve multiple sites in the body. When a diagnosis of cancer is made, one of the first problems that needs to be solved is determining what part of the body the process began in. Because cancer may spread to distant locations, the discovery of a mass in a lung doesn't necessarily mean the patient has "lung cancer"; if this occurs in the liver, it doesn't necessarily mean that the patient has "liver cancer."

To determine the best therapy, doctors need to know the location(s) of the tumor(s) and where the cancer started. For example, the chemotherapy used in the treatment of breast cancer (that may have spread to the liver or lungs) is very different from what would be used if the cancer in the breast is actually a liver or lung cancer.

Certain relatively uncommon conditions clearly behave like a malignancy, but under the microscope the *pathologist* (doctor who interprets changes caused by disease in tissues and body fluids to make a diagnosis) is unable to classify the condition as falling into this group of illnesses. So, in rare situations, tumors that appear to be "benign" have been documented to have spread to other parts of the body, and tumors that are "noninvasive" may be found in multiple locations (see the "Building your cancer vocabulary" sidebar, earlier in this chapter). This experience emphasizes the complexity of cancer and the need for scientists to continue to learn more about this group of diseases to ultimately improve treatments and outcomes.

Grasping the Diagnostic Tests

On your way to getting your cancer diagnosis, you probably felt like a pin cushion, constantly being poked and prodded. You may have also been stuffed into or squeezed by various machines to get a closer look at your body tissues. During your cancer treatment, you'll experience more of this. These events are never fun and may leave you feeling anxious, but they're important for getting a more accurate clinical picture of your cancer so that it can be treated optimally while minimizing the risk of side effects.

In this section, we take a closer look at some of the types of tests you'll undergo on your cancer journey. If you understand them a bit better, maybe they won't be quite so scary.

Blood tests

A variety of blood tests are often used to help make an initial diagnosis of cancer. But although certain blood tests may be very helpful in suggesting the presence of cancer, the "gold standard" for diagnosing a malignancy is a formal analysis of a tissue sample (or blood) under the microscope by a pathologist (see "Biopsies," later in this chapter).

Specific examples of useful blood tests in the diagnosis of cancer include the PSA test for prostate cancer (although some recent debate has been raised after an expert panel recommended against performing the test in men of any age group) and the CA-125 test for ovarian cancer. Again, finding abnormal blood levels in these particular tests would lead to further evaluation and, most likely, a tissue biopsy (for example, of the prostate or a mass in the abdomen) to make a definitive diagnosis.

Blood tests are also useful in determining whether a particular cancer may have spread to other locations in your body. For example, certain abnormalities in what are often called "liver function tests" may suggest that your malignancy has spread to your liver. They can also be very helpful in evaluating your ability to undergo specific treatments. For example, abnormal "kidney function tests" may indicate a preexisting kidney problem that may make it difficult to administer certain chemotherapy agents due to the risk of serious side effects.

In addition, after the diagnosis is made, the actual level of a particular blood test may be used to monitor the course of the illness. These are called *tumor markers.* For example, if you have ovarian cancer, monitoring your blood level of CA-125 is a useful approach to determine the effectiveness of your chemotherapy regimen.

Imaging studies

As with blood tests, imaging studies can be very helpful, but they aren't considered (except in very rare situations) diagnostic of cancer. However, they can clearly show the site of a primary tumor and of possible locations of secondary tumors (see the "Building your cancer vocabulary" sidebar, earlier in this chapter, for more on primary and secondary tumors). Examples of imaging tests used to assess for cancer include mammograms for breast cancer, chest X-rays and computed tomography (CT) scans for lung cancer, abdominal CT scans for ovarian and pancreatic cancer, and magnetic resonance imaging (MRI) for brain cancers.

As with blood tests, imaging studies can monitor your response to treatment and identify any disease progression. One of the most exciting developments in the area of cancer diagnosis over the past decade has been advancement in the imaging technologies designed to find and monitor malignant disease — for example, the advent of positron emission tomography (PET) scanning, which, unlike CT scans and MRIs that look at the body's anatomy, produces a three-dimensional picture of functional processes in the body.

Biopsies

The "gold standard" for the diagnosis of cancer is the careful analysis of actual tumor tissue under the microscope by a pathologist. This requires a piece of tissue (or blood, in the case of leukemias and other bone marrow diseases) to be obtained for this specific purpose.

Although the biopsy material may come from your tumor following a surgery that was planned to remove the malignancy, in most circumstances, you'll undergo a biopsy before such surgery. This is because confirming the diagnosis in advance permits you and your doctor to discuss and decide upon the best strategy based on the biopsy results. For example, if you undergo a needle biopsy of a breast lump you discovered in the shower one day, certain important features of your cancer, such as the presence or absence of certain receptors, will influence the treatment options that are available to you.

An initial attempt to get enough material for a definitive diagnosis sometimes isn't successful. This situation may occur for several reasons. For example, an insufficient amount of tissue may have been obtained; the sample may have appeared "normal," but it's suspected that the actual cancer site was missed in the biopsy attempt; or the cells may have been *necrotic* (dead or dying cells with insufficient features to permit a diagnosis). In such cases, you may need to undergo a second biopsy.

Getting a Handle on Cancer Staging

Staging is a way to describe the severity of your cancer based on the extent of your original (primary) tumor and whether your cancer has spread to other areas of your body. Staging is important because it can enable your oncologist to work with you to develop an appropriate treatment plan. It can also help give some indication of your prognosis. But remember, no one can tell you for sure what your prognosis will be.

Staging is important language when it comes to cancer, so this section fills you in on everything you need to know about it, including how cancer is staged and what these stages mean.

How cancer is staged

There is a well-established cancer "staging system" that is widely used by oncologists, which is both a good thing and a bad thing. It's a good thing because oncologists and pathologists around the world generally agree with the system. As a result, you can be confident that if you're given a "stage" for your cancer after a definitive evaluation by your oncologist, you would have received that same stage had that evaluation been conducted by another oncologist. This is because doctors follow agreed-upon criteria for staging, which is as follows:

- **Stage 0:** The cancer is noninvasive.
- **Stages I, II, and III:** The higher the number, the more extensive the disease. The tumor may be larger or may have spread beyond the organ in which it first developed to nearby lymph nodes and/or organs adjacent to the location of the primary tumor.
- **Stage IV:** The cancer has spread to distant sites in the body.

Sometimes additional letters and numerical suffixes are used to subdivide cancer stages. For example, a stage IIIE+S tumor indicates extralymphatic spread (as marked by the *E*) and splenic involvement (as marked by the *S*).

Now the bad news. Because the fundamental concepts behind tumor staging haven't changed substantially since the process was developed many decades ago, certain assumptions considered reasonable at that time don't appear to be appropriate today. Perhaps the most important fact is that formal staging is only done at the initial diagnosis. The drawback of this system is that it doesn't account for recurrence or metastasis, which may occur sometime after a tumor is initially staged.

With the exception of blood-related malignancies (leukemia, myeloma, lymphoma), most cancers are staged based on findings at the time of initial

surgery. Additional information to define the cancer stage may come from imaging studies (such as a CT scan of the lungs or abdomen) and specific blood tumor marker studies.

Patients who experience a cancer recurrence in a distant site commonly say that they have "stage IV cancer," but this isn't technically correct. A cancer that initially presents as a localized process ("stage I") will always be labeled as stage I. Clearly, this situation can be quite confusing.

What cancer staging truly means

The stage of a cancer provides very general information about the extent of its spread and observed location within the body. In most cases, this information is essential in defining the best initial treatment plan. For example, if you have a lung cancer that appears to be entirely localized without involvement of regional lymph nodes, it will be treated with surgery (assuming you're medically able to tolerate it); on the other hand, if you have extensive lymph node involvement, you probably won't undergo surgery, and you'll have radiation plus chemotherapy instead.

The relevance of staging varies based on the specific tumor type in question and the available treatment options to be considered in that particular setting. For example, surgery may be used to treat one tumor type (such as ovarian cancer) even in the presence of documented stage IV cancer, while documented regional lymph node involvement (stage II) for other tumor types may modify the therapeutic strategy away from surgery and toward radiation. These decisions are largely based on the results of large-scale clinical trials that have been conducted over the past several decades and have helped to define optimal disease management in particular clinical settings.

Blood tumors are all essentially "stage IV" at diagnosis, and treatment will be with anticancer drugs (possibly with external radiation to large masses) rather than surgery.

Unfortunately, despite improvements in diagnostics, it's impossible to precisely know if an individual cancer truly remains localized at the time of diagnosis, despite negative imaging or tumor marker studies. Therefore, although you may have stage I breast cancer, you may, in fact, have *microscopic* (unable to be seen on imaging studies) metastatic cancer. This is why adjuvant chemotherapy is given for certain cancer types.

Despite the drawbacks and challenges of cancer staging, in general, prognosis is excellent when you're found to have an early-stage cancer, rather than more advanced disease. However, with the increasing effectiveness of treatment options for multiple tumor types — even advanced cancers — you can experience genuinely meaningful benefits associated with treatment, including substantial improvement in cancer-related symptoms, improved quality of life, and prolonged survival.