



# Breast Cancer

## What is cancer?

The body is made up of trillions of living cells. Normal body cells grow, divide into new cells, and die in an orderly way. During the early years of a person's life, normal cells divide faster to allow the person to grow. After the person becomes an adult, most cells divide only to replace worn-out or dying cells or to repair injuries.

Cancer begins when cells in a part of the body start to grow out of control. There are many kinds of cancer, but they all start because of out-of-control growth of abnormal cells.

Cancer cell growth is different from normal cell growth. Instead of dying, cancer cells continue to grow and form new, abnormal cells. Cancer cells can also invade (grow into) other tissues, something that normal cells cannot do. Growing out of control and invading other tissues are what makes a cell a cancer cell.

Cells become cancer cells because of damage to DNA. DNA is in every cell and directs all its actions. In a normal cell, when DNA gets damaged the cell either repairs the damage or the cell dies. In cancer cells, the damaged DNA is not repaired, but the cell doesn't die like it should. Instead, this cell goes on making new cells that the body does not need. These new cells will all have the same damaged DNA as the first cell does.

People can inherit damaged DNA, but most DNA damage is caused by mistakes that happen while the normal cell is reproducing or by something in our environment. Sometimes the cause of the DNA damage is something obvious, like cigarette smoking. But often no clear cause is found.

In most cases the cancer cells form a tumor. Some cancers, like leukemia, rarely form tumors. Instead, these cancer cells involve the blood and blood-forming organs and circulate through other tissues where they grow.

Cancer cells often travel to other parts of the body, where they begin to grow and form new tumors that replace normal tissue. This process is called *metastasis*. It happens when the cancer cells get into the bloodstream or lymph vessels of our body.

No matter where a cancer may spread, it is always named for the place where it started. For example, breast cancer that has spread to the liver is still called breast cancer, not liver cancer. Likewise, prostate cancer that has spread to the bone is metastatic prostate cancer, not bone cancer.

Different types of cancer can behave very differently. For example, lung cancer and breast cancer are very different diseases. They grow at different rates and respond to different treatments. That is why people with cancer need treatment that is aimed at their particular kind of cancer.

Not all tumors are cancerous. Tumors that aren't cancer are called *benign*. Benign tumors can cause problems – they can grow very large and press on healthy organs and tissues. But they cannot grow into (invade) other tissues. Because they can't invade, they also can't spread to other parts of the body (metastasize). These tumors are almost never life threatening.

## What is breast cancer?

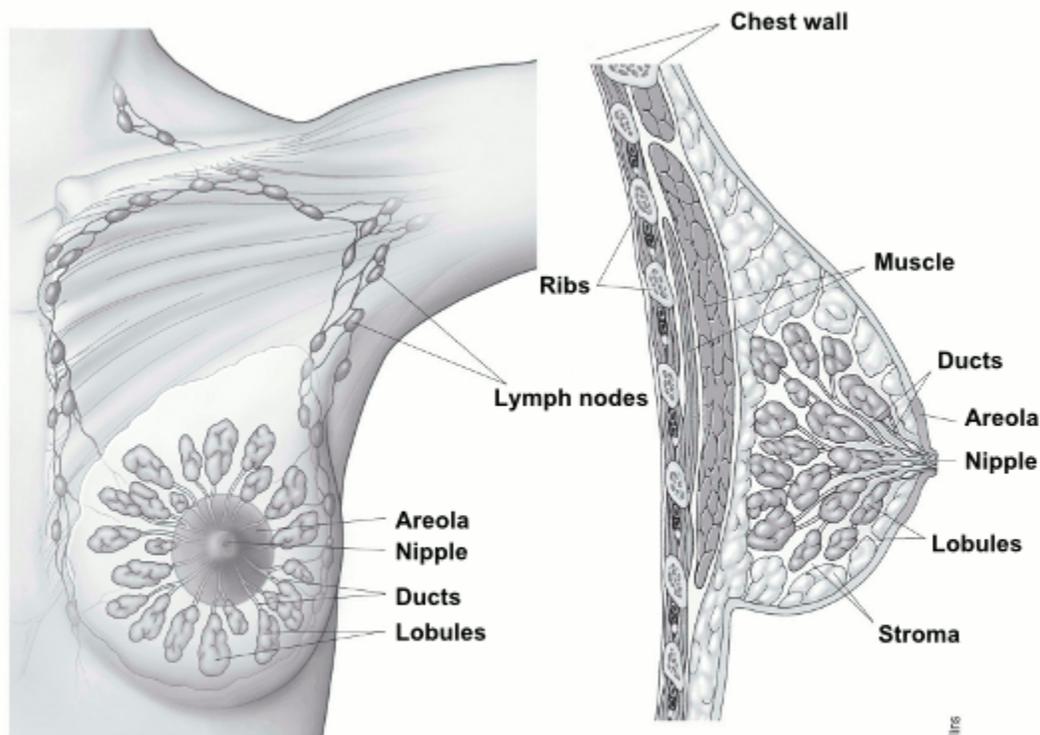
Breast cancer is a malignant tumor that starts in the cells of the breast. A malignant tumor is a group of cancer cells that can grow into (invade) surrounding tissues or spread (metastasize) to distant areas of the body. The disease occurs almost entirely in women, but men can get it, too.

**The remainder of this document refers only to breast cancer in women. For information on breast cancer in men, see our document *Breast Cancer in Men*.**

### The normal breast

To understand breast cancer, it helps to have some basic knowledge about the normal structure of the breasts, shown in the diagram below.

The female breast is made up mainly of *lobules* (milk-producing glands), *ducts* (tiny tubes that carry the milk from the lobules to the nipple), and *stroma* (fatty tissue and connective tissue surrounding the ducts and lobules, blood vessels, and lymphatic vessels).



## Normal breast tissue

Most breast cancers begin in the cells that line the ducts (*ductal* cancers). Some begin in the cells that line the lobules (*lobular* cancers), while a small number start in other tissues.

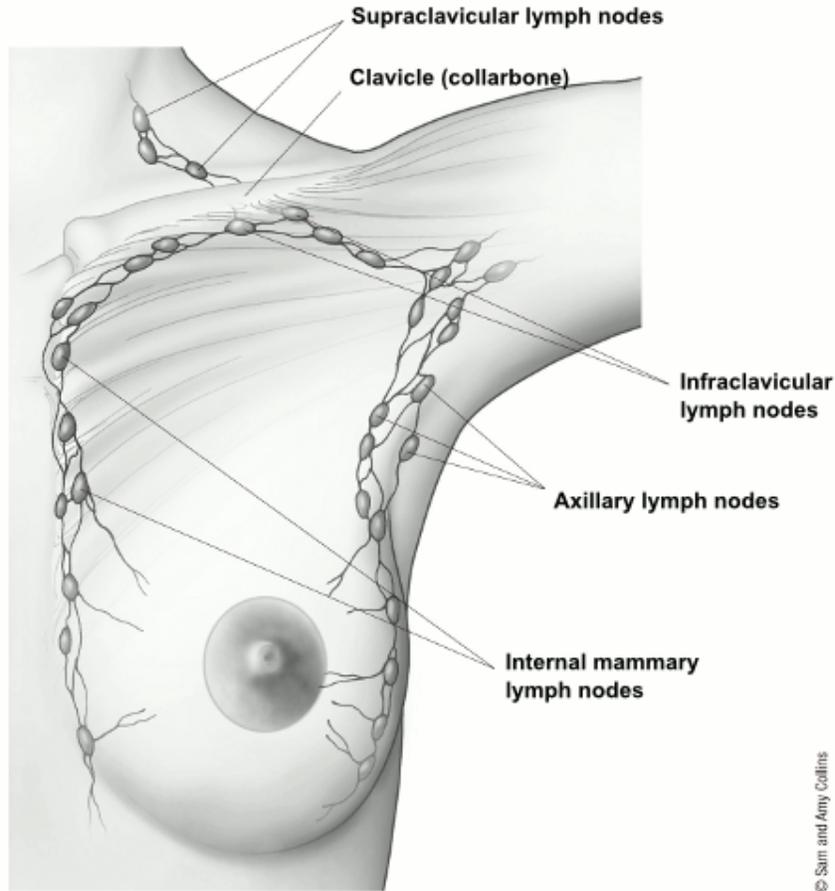
### The lymph (lymphatic) system of the breast

The lymph system is important to understand because it is one way breast cancers can spread. This system has several parts.

Lymph nodes are small, bean-shaped collections of immune system cells (cells that are important in fighting infections) that are connected by lymphatic vessels. Lymphatic vessels are like small veins, except that they carry a clear fluid called *lymph* (instead of blood) away from the breast. Lymph contains tissue fluid and waste products, as well as immune system cells. Breast cancer cells can enter lymphatic vessels and begin to grow in lymph nodes.

Most lymphatic vessels in the breast connect to lymph nodes under the arm (*axillary nodes*). Some lymphatic vessels connect to lymph nodes inside the chest (*internal*

*mammary nodes*) and either above or below the collarbone (*supraclavicular* or *infraclavicular nodes*).



## Lymph nodes in relation to the breast

If the cancer cells have spread to lymph nodes, there is a higher chance that the cells could have also gotten into the bloodstream and spread (metastasized) to other sites in the body. The more lymph nodes with breast cancer cells, the more likely it is that the cancer may be found in other organs as well. Because of this, finding cancer in one or more lymph nodes often affects the treatment plan. Still, not all women with cancer cells in their lymph nodes develop metastases, and some women can have no cancer cells in their lymph nodes and later develop metastases.

## Benign breast lumps

Most breast lumps are not cancerous (benign). Still, some may need to be biopsied (sampled and viewed under a microscope) to prove they are not cancer.

### Fibrosis and cysts

Most lumps turn out to be caused by fibrosis and/or cysts, benign changes in the breast tissue that happen in many women at some time in their lives. (This is sometimes called *fibrocystic changes* and used to be called *fibrocystic disease*.) Fibrosis is the formation of scar-like (fibrous) tissue, and cysts are fluid-filled sacs. These conditions are most often diagnosed by a doctor based on symptoms, such as breast lumps, swelling, and tenderness or pain. These symptoms tend to be worse just before a woman's menstrual period is about to begin. Her breasts may feel lumpy and, sometimes, she may notice a clear or slightly cloudy nipple discharge.

### Fibroadenomas and intraductal papillomas

Benign breast tumors such as *fibroadenomas* or *intraductal papillomas* are abnormal growths, but they are not cancerous and do not spread outside the breast to other organs. They are not life threatening.

Still, some benign breast conditions are important because women with these conditions have a higher risk of developing breast cancer. For more information see the section "What are the risk factors for breast cancer?" and our document *Non-cancerous Breast Conditions*.

## Types of breast cancers

Breast cancer can be separated into different types based on the way the cancer cells look under the microscope.

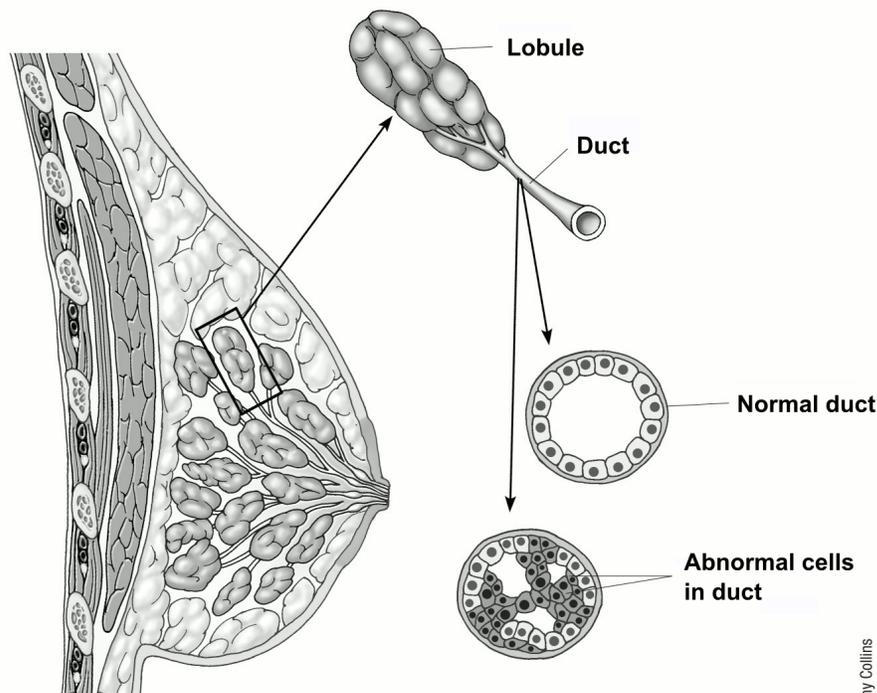
Most breast cancers are *carcinomas*, a type of cancer that starts in the cells (epithelial cells) that line organs and tissues like the breast. In fact, breast cancers are often a type of carcinoma called *adenocarcinoma*, which is carcinoma that starts in glandular tissue. Other types of cancers can occur in the breast, too, such as sarcomas, which start in the cells of muscle, fat, or connective tissue.

In some cases a single breast tumor can be a combination of different types or be a mixture of invasive and in situ cancer. And in some rarer types of breast cancer, the cancer cells may not form a tumor at all.

Breast cancer can also be classified based on proteins on or in the cancer cells, into groups like hormone receptor-positive or triple-negative. These are discussed in the section "How is breast cancer classified?"

## Ductal carcinoma in situ

Ductal carcinoma in situ (DCIS; also known as *intraductal carcinoma*) is considered non-invasive or pre-invasive breast cancer. DCIS means that cells that lined the ducts have changed to look like cancer cells. The difference between DCIS and invasive cancer is that the cells have not spread (*invaded*) through the walls of the ducts into the surrounding breast tissue. Because it hasn't invaded, DCIS can't spread (metastasize) outside the breast. DCIS is considered a pre-cancer because some cases can go on to become invasive cancers. Right now, though, there is no good way to know for certain which cases will go on to become invasive cancers and which ones won't.



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## Ductal carcinoma in situ

About 1 in 5 new breast cancer cases will be DCIS. Nearly all women diagnosed at this early stage of breast cancer can be cured.

## Invasive (or infiltrating) ductal carcinoma

This is the most common type of breast cancer. Invasive (or infiltrating) ductal carcinoma (IDC) starts in a milk duct of the breast, breaks through the wall of the duct, and grows into the fatty tissue of the breast. At this point, it may be able to spread (metastasize) to other parts of the body through the lymphatic system and bloodstream. About 8 of 10 invasive breast cancers are infiltrating ductal carcinomas.

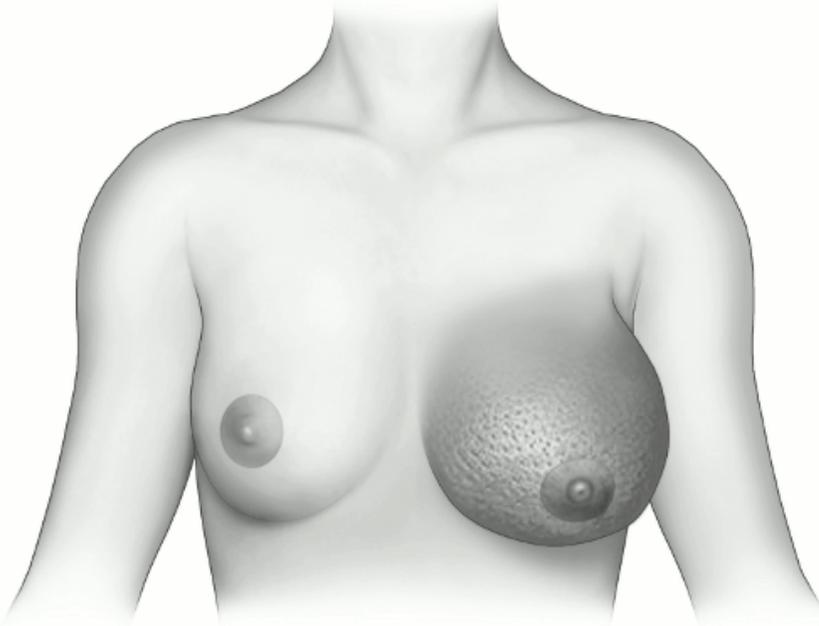
## Invasive (or infiltrating) lobular carcinoma

Invasive lobular carcinoma (ILC) starts in the milk-producing glands (lobules). Like IDC, it can spread (metastasize) to other parts of the body. About 1 in 10 invasive breast cancers is an ILC. Invasive lobular carcinoma may be harder to detect by a mammogram than invasive ductal carcinoma.

## Less common types of breast cancer

### **Inflammatory breast cancer**

This uncommon type of invasive breast cancer accounts for about 1% to 3% of all breast cancers. Usually there is no single lump or tumor. Instead, inflammatory breast cancer (IBC) makes the skin on the breast look red and feel warm. It also may give the breast skin a thick, pitted appearance that looks a lot like an orange peel. Doctors now know that these changes are not caused by inflammation or infection, but by cancer cells blocking lymph vessels in the skin. The affected breast may become larger or firmer, tender, or itchy.



**Inflammatory breast cancer**

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In its early stages, inflammatory breast cancer is often mistaken for an infection in the breast (called *mastitis*) and treated as an infection with antibiotics. If the symptoms are caused by cancer, they will not improve, and a biopsy will find cancer cells. Because there is no actual lump, it might not show up on a mammogram, which can make it even

harder to find it early. This type of breast cancer tends to have a higher chance of spreading and a worse outlook (prognosis) than typical invasive ductal or lobular cancer. For more details about this condition, see our document *Inflammatory Breast Cancer*.

## **Paget disease of the nipple**

This type of breast cancer starts in the breast ducts and spreads to the skin of the nipple and then to the areola, the dark circle around the nipple. It is rare, accounting for only about 1% of all cases of breast cancer. The skin of the nipple and areola often appears crusted, scaly, and red, with areas of bleeding or oozing. The woman may notice burning or itching.

Paget disease is almost always associated with either ductal carcinoma in situ (DCIS) or infiltrating ductal carcinoma. Treatment often requires mastectomy. If no lump can be felt in the breast tissue, and the biopsy shows DCIS but no invasive cancer, the outlook (prognosis) is excellent. If invasive cancer is present, the prognosis is not as good, and the cancer will need to be staged and treated like any other invasive cancer.

## **Phyllodes tumor**

This very rare breast tumor develops in the stroma (connective tissue) of the breast, in contrast to carcinomas, which develop in the ducts or lobules. Other names for these tumors include *phylloides tumor* and *cystosarcoma phyllodes*. These tumors are usually benign but on rare occasions may be malignant.

Benign phyllodes tumors are treated by removing the tumor along with a margin of normal breast tissue. A malignant phyllodes tumor is treated by removing it along with a wider margin of normal tissue, or by mastectomy. Surgery is often all that is needed, but these cancers might not respond as well to the other treatments used for more common breast cancers. When a malignant phyllodes tumor has spread, it can be treated with the chemotherapy given for soft-tissue sarcomas. See our document *Sarcoma - Adult Soft Tissue Cancer*.

## **Angiosarcoma**

This form of cancer starts in cells that line blood vessels or lymph vessels. It rarely occurs in the breasts. When it does, it usually develops as a complication of previous radiation treatments. This is an extremely rare complication of breast radiation therapy that can develop about 5 to 10 years after radiation. Angiosarcoma can also occur in the arms of women who develop lymphedema as a result of lymph node surgery or radiation therapy to treat breast cancer. (For information on lymphedema, see the section "How is breast cancer treated?") These cancers tend to grow and spread quickly. Treatment is generally the same as for other sarcomas. See our document *Sarcoma - Adult Soft Tissue Cancer*.

## Special types of invasive breast carcinoma

There are some special types of breast cancer that are sub-types of invasive carcinoma. These are often named after features seen when they are viewed under the microscope, like the ways the cells are arranged.

Some of these may have a better prognosis than standard infiltrating ductal carcinoma. These include:

- Adenoid cystic (or adenocystic) carcinoma
- Low-grade adenosquamous carcinoma (this is a type of metaplastic carcinoma)
- Medullary carcinoma
- Mucinous (or colloid) carcinoma
- Papillary carcinoma
- Tubular carcinoma

Some sub-types have the same or maybe worse prognosis than standard infiltrating ductal carcinoma. These include:

- Metaplastic carcinoma (most types, including spindle cell and squamous)
- Micropapillary carcinoma
- Mixed carcinoma (has features of both invasive ductal and lobular)

In general, all of these sub-types are still treated like standard infiltrating ductal carcinoma.

## What are the key statistics about breast cancer?

Breast cancer is the most common cancer among American women, except for skin cancers. About 1 in 8 (12%) women in the US will develop invasive breast cancer during their lifetime.

The American Cancer Society's estimates for breast cancer in the United States for 2015 are:

- About 231,840 new cases of invasive breast cancer will be diagnosed in women.
- About 60,290 new cases of carcinoma in situ (CIS) will be diagnosed (CIS is non-invasive and is the earliest form of breast cancer).

- About 40,290 women will die from breast cancer

After increasing for more than 2 decades, female breast cancer incidence rates began decreasing in 2000, then dropped by about 7% from 2002 to 2003. This large decrease was thought to be due to the decline in use of hormone therapy after menopause that occurred after the results of the Women's Health Initiative were published in 2002. This study linked the use of hormone therapy to an increased risk of breast cancer and heart diseases. In recent years, incidence rates have been stable in white women, but have increased slightly in African American women.

Breast cancer is the second leading cause of cancer death in women, exceeded only by lung cancer. The chance that breast cancer will be responsible for a woman's death is about 1 in 36 (about 3%). Death rates from breast cancer have been declining since about 1989, with larger decreases in women younger than 50. These decreases are believed to be the result of earlier detection through screening and increased awareness, as well as improved treatment.

At this time there are more than 2.8 million breast cancer survivors in the United States. (This includes women still being treated and those who have completed treatment.) Survival rates are discussed in the section "Breast cancer survival rates by stage."

## **What are the risk factors for breast cancer?**

A risk factor is anything that affects your chance of getting a disease, such as cancer. Different cancers have different risk factors. For example, exposing skin to strong sunlight is a risk factor for skin cancer. Smoking is a risk factor for cancers of the lung, mouth, larynx (voice box), bladder, kidney, and several other organs.

But risk factors don't tell us everything. Having a risk factor, or even several, does not mean that you will get the disease. Most women who have one or more breast cancer risk factors never develop the disease, while many women with breast cancer have no apparent risk factors (other than being a woman and growing older). Even when a woman with risk factors develops breast cancer, it is hard to know just how much these factors might have contributed.

Some risk factors, like a person's age or race, can't be changed. Others are linked to cancer-causing factors in the environment. Still others are related to personal behaviors, such as smoking, drinking, and diet. Some factors influence risk more than others, and your risk for breast cancer can change over time, due to factors such as aging or lifestyle.

## Risk factors not related to personal choice

### Gender

Simply being a woman is the main risk factor for developing breast cancer. Men can develop breast cancer, but this disease is about 100 times more common among women than men. This is probably because men have less of the female hormones estrogen and progesterone, which can promote breast cancer cell growth

### Aging

Your risk of developing breast cancer increases as you get older. About 1 out of 8 invasive breast cancers are found in women younger than 45, while about 2 of 3 invasive breast cancers are found in women age 55 or older.

### Genetic risk factors

About 5% to 10% of breast cancer cases are thought to be hereditary, meaning that they result directly from gene defects (called *mutations*) inherited from a parent. See the section "Do we know what causes breast cancer?" for more information about genes and DNA and how they can affect breast cancer risk.

***BRCA1* and *BRCA2*:** The most common cause of hereditary breast cancer is an inherited mutation in the *BRCA1* and *BRCA2* genes. In normal cells, these genes help prevent cancer by making proteins that keep the cells from growing abnormally. If you have inherited a mutated copy of either gene from a parent, you have a high risk of developing breast cancer during your lifetime.

Although in some families with *BRCA1* mutations the lifetime risk of breast cancer is as high as 80%, on average this risk seems to be in the range of 55 to 65%. For *BRCA2* mutations the risk is lower, around 45%.

Breast cancers linked to these mutations occur more often in younger women and more often affect both breasts than cancers not linked to these mutations. Women with these inherited mutations also have an increased risk for developing other cancers, particularly ovarian cancer.

In the United States *BRCA* mutations are more common in Jewish people of Ashkenazi (Eastern Europe) origin than in other racial and ethnic groups, but they can occur in anyone.

**Changes in other genes:** Other gene mutations can also lead to inherited breast cancers. These gene mutations are much rarer and often do not increase the risk of breast cancer as much as the *BRCA* genes. They are not frequent causes of inherited breast cancer.

- **ATM:** The *ATM* gene normally helps repair damaged DNA. Inheriting 2 abnormal copies of this gene causes the disease ataxia-telangiectasia. Inheriting 1 mutated copy of this gene has been linked to a high rate of breast cancer in some families.
- **TP53:** The *TP53* gene gives instructions for making a protein called p53 that helps stop the growth of abnormal cells. Inherited mutations of this gene cause *Li-Fraumeni syndrome* (named after the 2 researchers who first described it). People with this syndrome have an increased risk of developing breast cancer, as well as several other cancers such as leukemia, brain tumors, and sarcomas (cancer of bones or connective tissue). This is a rare cause of breast cancer.
- **CHEK2:** The Li-Fraumeni syndrome can also be caused by inherited mutations in the *CHEK2* gene. Even when it does not cause this syndrome, it can increase breast cancer risk about twofold when it is mutated.
- **PTEN:** The *PTEN* gene normally helps regulate cell growth. Inherited mutations in this gene can cause *Cowden syndrome*, a rare disorder in which people are at increased risk for both benign and malignant breast tumors, as well as growths in the digestive tract, thyroid, uterus, and ovaries. Defects in this gene can also cause a different syndrome called Bannayan-Riley-Ruvalcaba syndrome that is not thought to be linked to breast cancer risk. Recently, the syndromes caused by *PTEN* have been combined into one called PTEN Tumor Hamartoma Syndrome.
- **CDH1:** Inherited mutations in this gene cause *hereditary diffuse gastric cancer*, a syndrome in which people develop a rare type of stomach cancer at an early age. Women with mutations in this gene also have an increased risk of invasive lobular breast cancer.
- **STK11:** Defects in this gene can lead to *Peutz-Jeghers syndrome*. People with this disorder develop pigmented spots on their lips and in their mouths, polyps in the urinary and gastrointestinal tracts, and have an increased risk of many types of cancer, including breast cancer.
- **PALB2:** The *PALB2* gene makes a protein that interacts with the protein made by the *BRCA2* gene. Defects (mutations) in this gene can lead to an increased risk of breast cancer. It isn't yet clear if *PALB2* gene mutations also increase the risk for ovarian cancer and male breast cancer.

**Genetic testing:** Genetic tests can be done to look for mutations in the *BRCA1* and *BRCA2* genes (or some other genes linked to breast cancer risk). Although testing may be helpful in some situations, the pros and cons need to be considered carefully. For more information, see the section "Can breast cancer be prevented?"

## Family history of breast cancer

Breast cancer risk is higher among women whose close blood relatives have this disease.

Having one first-degree relative (mother, sister, or daughter) with breast cancer approximately doubles a woman's risk. Having 2 first-degree relatives increases her risk about 3-fold.

The exact risk is not known, but women with a family history of breast cancer in a father or brother also have an increased risk of breast cancer. Altogether, less than 15% of women with breast cancer have a family member with this disease. This means that most (over 85%) women who get breast cancer *do not* have a family history of this disease.

## **Personal history of breast cancer**

A woman with cancer in one breast has a 3- to 4-fold increased risk of developing a new cancer in the other breast or in another part of the same breast. This is different from a recurrence (return) of the first cancer.

## **Race and ethnicity**

Overall, white women are slightly more likely to develop breast cancer than are African-American women, but African-American women are more likely to die of this cancer. However, in women under 45 years of age, breast cancer is more common in African-American women. Asian, Hispanic, and Native-American women have a lower risk of developing and dying from breast cancer.

## **Dense breast tissue**

Breasts are made up of fatty tissue, fibrous tissue, and glandular tissue. Someone is said to have dense breast tissue (as seen on a mammogram) when they have more glandular and fibrous tissue and less fatty tissue. Women with dense breasts on mammogram have a risk of breast cancer that is 1.2 to 2 times that of women with average breast density. Unfortunately, dense breast tissue can also make mammograms less accurate.

A number of factors can affect breast density, such as age, menopausal status, certain medications (including menopausal hormone therapy), pregnancy, and genetics.

## **Certain benign breast conditions**

Women diagnosed with certain benign breast conditions might have an increased risk of breast cancer. Some of these conditions are more closely linked to breast cancer risk than others. Doctors often divide benign breast conditions into 3 general groups, depending on how they affect this risk.

**Non-proliferative lesions:** These conditions are not associated with overgrowth of breast tissue. They do not seem to affect breast cancer risk, or if they do, it is to a very small extent. They include:

- Fibrosis and/or simple cysts (this used to be called *fibrocystic disease* or *changes*)
- Mild hyperplasia
- Adenosis (non-sclerosing)
- Ductal ectasia
- Phyllodes tumor (benign)
- A single papilloma
- Fat necrosis
- Periductal fibrosis
- Squamous and apocrine metaplasia
- Epithelial-related calcifications
- Other benign tumors (lipoma, hamartoma, hemangioma, neurofibroma, adenomyoepithelioma)

Mastitis (infection of the breast) is not a lesion, but is a condition that can occur that does not increase the risk of breast cancer.

**Proliferative lesions without atypia:** These conditions show excessive growth of cells in the ducts or lobules of the breast tissue. They seem to raise a woman's risk of breast cancer slightly (1½ to 2 times normal). They include:

- Usual ductal hyperplasia (without atypia)
- Fibroadenoma
- Sclerosing adenosis
- Several papillomas (called *papillomatosis*)
- Radial scar

**Proliferative lesions with atypia:** In these conditions, there is an overgrowth of cells in the ducts or lobules of the breast tissue, with some of the cells no longer appearing normal. They have a stronger effect on breast cancer risk, raising it 3½ to 5 times higher than normal. These types of lesions include:

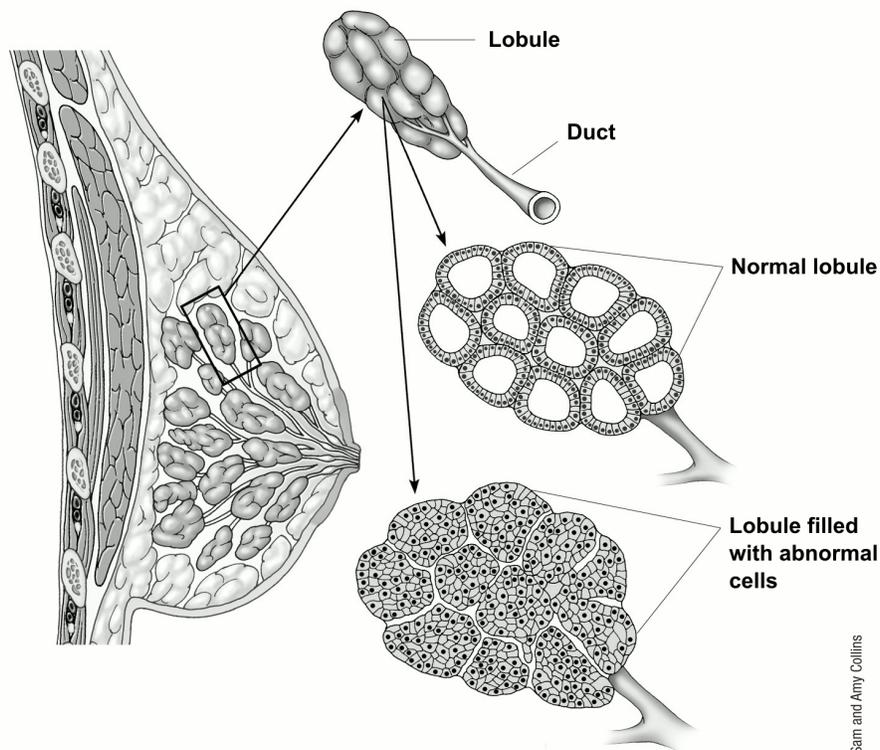
- Atypical ductal hyperplasia (ADH)
- Atypical lobular hyperplasia (ALH)

Women with a family history of breast cancer and either hyperplasia or atypical hyperplasia have an even higher risk of developing a breast cancer.

For more information on these conditions, see our document *Non-cancerous Breast Conditions*.

## Lobular carcinoma in situ

In lobular carcinoma in situ (LCIS) cells that look like cancer cells are growing in the lobules of the milk-producing glands of the breast, but they do not grow through the wall of the lobules. LCIS (also called *lobular neoplasia*) is sometimes grouped with ductal carcinoma in situ (DCIS) as a non-invasive breast cancer, but it differs from DCIS in that it doesn't seem to become an invasive cancer if it isn't treated.



## Lobular carcinoma in situ

Women with this condition have a 7- to 11-fold increased risk of developing invasive cancer in either breast. For this reason, women with LCIS should make sure they have regular mammograms and doctor visits.

## **Menstrual periods**

Women who have had more menstrual cycles because they started menstruating early (before age 12) and/or went through menopause later (after age 55) have a slightly higher risk of breast cancer. The increase in risk may be due to a longer lifetime exposure to the hormones estrogen and progesterone.

## **Previous chest radiation**

Women who, as children or young adults, had radiation therapy to the chest area as treatment for another cancer (such as lymphoma) have a significantly increased risk for breast cancer. This varies with the patient's age when they had radiation. If chemotherapy was also given, it may have stopped ovarian hormone production for some time, lowering the risk. The risk of developing breast cancer from chest radiation is highest if the radiation was given during adolescence, when the breasts were still developing. Radiation treatment after age 40 does not seem to increase breast cancer risk.

## **Diethylstilbestrol exposure**

From the 1940s through the 1960s some pregnant women were given the drug diethylstilbestrol (DES) because it was thought to lower their chances of miscarriage (losing the baby). These women have a slightly increased risk of developing breast cancer. Women whose mothers took DES during pregnancy may also have a slightly higher risk of breast cancer. For more information on DES see our document *DES Exposure: Questions and Answers*.

## **Lifestyle-related factors and breast cancer risk**

### **Having children**

Women who have had no children or who had their first child after age 30 have a slightly higher breast cancer risk overall. Having many pregnancies and becoming pregnant at a young age reduce breast cancer risk overall. Still, the effect of pregnancy is different for different types of breast cancer. For a certain type of breast cancer known as triple-negative, pregnancy seems to increase risk.

### **Birth control**

**Oral contraceptives:** Studies have found that women using oral contraceptives (birth control pills) have a slightly greater risk of breast cancer than women who have never used them. This risk seems to go back to normal over time once the pills are stopped. Women who stopped using oral contraceptives more than 10 years ago do not appear to have any increased breast cancer risk. When thinking about using oral contraceptives,

women should discuss their other risk factors for breast cancer with their health care team.

**Depot-medroxyprogesterone acetate** (DMPA; Depo-Provera<sup>®</sup>) is an injectable form of progesterone that is given once every 3 months as birth control. A few studies have looked at the effect of DMPA on breast cancer risk. Women currently using DMPA seem to have an increase in risk, but the risk doesn't seem to be increased if this drug was used more than 5 years ago.

## **Hormone therapy after menopause**

Hormone therapy with estrogen (often combined with progesterone) has been used for many years to help relieve symptoms of menopause and to help prevent osteoporosis (thinning of the bones). Earlier studies suggested it might have other health benefits as well, but these benefits have not been found in more recent, better designed studies. This treatment goes by many names, such as *post-menopausal hormone therapy* (PHT), *hormone replacement therapy* (HRT), and *menopausal hormone therapy* (MHT).

There are 2 main types of hormone therapy. For women who still have a uterus (womb), doctors generally prescribe both estrogen and progesterone (known as *combined hormone therapy* or *HT*). Progesterone is needed because estrogen alone can increase the risk of cancer of the uterus. For women who no longer have a uterus (those who've had a hysterectomy), estrogen alone can be prescribed. This is commonly known as *estrogen replacement therapy* (ERT) or just *estrogen therapy* (ET).

Studies have shown that using combined hormone therapy after menopause increases the risk of getting breast cancer. It may also increase the chances of dying from breast cancer.

The use of estrogen alone after menopause does not appear to increase the risk of developing breast cancer.

For more information about this topic, see our document *Menopausal Hormone Therapy*.

## **Breastfeeding**

Some studies suggest that breastfeeding may slightly lower breast cancer risk, especially if it is continued for 1½ to 2 years. But this has been a difficult area to study, especially in countries such as the United States, where breastfeeding for this long is uncommon.

One explanation for this possible effect may be that breastfeeding reduces a woman's total number of lifetime menstrual cycles (similar to starting menstrual periods at a later age or going through early menopause).

## **Drinking alcohol**

The use of alcohol is clearly linked to an increased risk of developing breast cancer. The risk increases with the amount of alcohol consumed. Compared with non-drinkers, women who consume 1 alcoholic drink a day have a very small increase in risk. Those who have 2 to 5 drinks daily have about 1½ times the risk of women who don't drink alcohol. Excessive alcohol consumption is also known to increase the risk of developing several other types of cancer.

## **Being overweight or obese**

Being overweight or obese after menopause increases breast cancer risk. Before menopause your ovaries produce most of your estrogen, and fat tissue produces a small amount of estrogen. After menopause (when the ovaries stop making estrogen), most of a woman's estrogen comes from fat tissue. Having more fat tissue after menopause can increase your chance of getting breast cancer by raising estrogen levels. Also, women who are overweight tend to have higher blood insulin levels. Higher insulin levels have also been linked to some cancers, including breast cancer.

But the connection between weight and breast cancer risk is complex. For example, the risk appears to be increased for women who gained weight as an adult but may not be increased among those who have been overweight since childhood. Also, excess fat in the waist area may affect risk more than the same amount of fat in the hips and thighs. Researchers believe that fat cells in various parts of the body have subtle differences that may explain this.

## **Physical activity**

Evidence is growing that physical activity in the form of exercise reduces breast cancer risk. The main question is how much exercise is needed. In one study from the Women's Health Initiative, as little as 1.25 to 2.5 hours per week of brisk walking reduced a woman's risk by 18%. Walking 10 hours a week reduced the risk a little more.

## **Unclear factors**

### **Diet and vitamin intake**

Many studies have looked for a link between what women eat and breast cancer risk, but so far the results have been conflicting. Some studies have indicated that diet may play a role, while others found no evidence that diet influences breast cancer risk. For example, a recent study found a higher risk of breast cancer in women who ate more red meat.

Studies have also looked at vitamin levels, again with inconsistent results. Some studies actually found an increased risk of breast cancer in women with higher levels of certain

nutrients. So far, no study has shown that taking vitamins reduces breast cancer risk. This is not to say that there is no point in eating a healthy diet. A diet low in fat, low in red meat and processed meat, and high in fruits and vegetables might have other health benefits.

Most studies have found that breast cancer is less common in countries where the typical diet is low in total fat, low in polyunsaturated fat, and low in saturated fat. But many studies of women in the United States have not linked breast cancer risk to dietary fat intake. Researchers are still not sure how to explain this apparent disagreement. It may be at least partly due to the effect of diet on body weight (see below). Also, studies comparing diet and breast cancer risk in different countries are complicated by other differences (like activity level, intake of other nutrients, and genetic factors) that might also affect breast cancer risk.

More research is needed to understand the effect of the types of fat eaten on breast cancer risk. But it is clear that calories do count, and fat is a major source of calories. High-fat diets can lead to being overweight or obese, which is a breast cancer risk factor. A diet high in fat has also been shown to influence the risk of developing several other types of cancer, and intake of certain types of fat is clearly related to heart disease risk.

## **Chemicals in the environment**

A great deal of research has been reported and more is being done to understand possible environmental influences on breast cancer risk.

Compounds in the environment that have estrogen-like properties are of special interest. For example, substances found in some plastics, certain cosmetics and personal care products, pesticides (such as DDE), and PCBs (polychlorinated biphenyls) seem to have such properties. These could in theory affect breast cancer risk.

This issue understandably invokes a great deal of public concern, but at this time research does not show a clear link between breast cancer risk and exposure to these substances. Unfortunately, studying such effects in humans is difficult. More research is needed to better define the possible health effects of these and similar substances.

## **Tobacco smoke**

For a long time, studies found no link between cigarette smoking and breast cancer. In recent years though, more studies have found that long-term heavy smoking is linked to a higher risk of breast cancer. Some studies have found that the risk is highest in certain groups, such as women who started smoking before they had their first child. The 2014 US Surgeon General's report on smoking concluded that there is "suggestive but not sufficient" evidence that smoking increases the risk of breast cancer.

An active focus of research is whether secondhand smoke increases the risk of breast cancer. Both mainstream and secondhand smoke contain chemicals that, in high concentrations, cause breast cancer in rodents. Chemicals in tobacco smoke reach breast tissue and are found in breast milk.

The evidence on secondhand smoke and breast cancer risk in human studies is controversial, at least in part because the link between smoking and breast cancer hasn't been clear. One possible explanation for this is that tobacco smoke may have different effects on breast cancer risk in smokers and in those who are just exposed to smoke.

A report from the California Environmental Protection Agency in 2005 concluded that the evidence about secondhand smoke and breast cancer is “consistent with a causal association” in younger, mainly premenopausal women. The 2014 US Surgeon General's report concluded that there is “suggestive but not sufficient” evidence of a link at this point. In any case, this possible link to breast cancer is yet another reason to avoid secondhand smoke.

## **Night work**

Several studies have suggested that women who work at night—for example, nurses on a night shift—may have an increased risk of developing breast cancer. This is a fairly recent finding, and more studies are looking at this issue. Some researchers think the effect may be due to changes in levels of melatonin, a hormone whose production is affected by the body's exposure to light, but other hormones are also being studied.

## **Controversial or disproven factors**

### **Antiperspirants**

Internet and e-mail rumors have suggested that chemicals in underarm antiperspirants are absorbed through the skin, interfere with lymph circulation, cause toxins to build up in the breast, and eventually lead to breast cancer.

Based on the available evidence (including what we know about how the body works), there is little if any reason to believe that antiperspirants increase the risk of breast cancer. For more information about this, see our document *Antiperspirants and Breast Cancer Risk*.

### **Bras**

Internet and e-mail rumors and at least one book have suggested that bras cause breast cancer by obstructing lymph flow. There is no good scientific or clinical basis for this claim, and a recent study of more than 1,500 women found no association of bra use with breast cancer risk.

## Induced abortion

Several studies have provided very strong data that neither induced abortions nor spontaneous abortions (miscarriages) have an overall effect on the risk of breast cancer. For more detailed information, see our document *Is Abortion Linked to Breast Cancer?*

## Breast implants

Several studies have found that breast implants do not increase the risk of breast cancer, although silicone breast implants can cause scar tissue to form in the breast. Implants make it harder to see breast tissue on standard mammograms, but additional x-ray pictures called *implant displacement* views can be used to examine the breast tissue more completely.

Breast implants may be linked to a rare type of lymphoma called *anaplastic large cell lymphoma*. This lymphoma has rarely been found in the breast tissue around the implants. So far, though, there are too few cases to know if the risk of this lymphoma is really higher in women that have implants.

## Do we know what causes breast cancer?

Many risk factors can increase your chance of developing breast cancer, but it is not yet known exactly how some of these risk factors cause cells to become cancerous. Hormones seem to play a role in many cases of breast cancer, but just how this happens is not fully understood.

DNA is the chemical in each of our cells that makes up our genes—the instructions for how our cells function. We usually look like our parents because they are the source of our DNA. But DNA affects more than how we look.

Some genes control when our cells grow, divide into new cells, and die. Genes that speed up cell division are called *oncogenes*. Others that slow down cell division, or cause cells to die at the right time, are called *tumor suppressor genes*. Certain changes (mutations) in DNA that “turn on” oncogenes or “turn off” tumor suppressor genes can cause normal breast cells to become cancerous.

## Inherited gene mutations

Certain inherited DNA mutations can dramatically increase the risk for developing certain cancers and are responsible for many of the cancers that run in some families. For example, the *BRCA* genes (*BRCA1* and *BRCA2*) are tumor suppressor genes. A mutation in one of these genes can be inherited from a parent. When one of these genes are mutated, it no longer suppresses abnormal growth, and cancer is more likely to develop.

Women have already begun to benefit from advances in understanding the genetic basis of breast cancer. Genetic testing can identify some women who have inherited mutations in the *BRCA1* or *BRCA2* tumor suppressor genes (or less commonly in other genes such as *PTEN* or *TP53*). These women can then take steps to reduce their risk of developing breast cancers and to monitor changes in their breasts carefully to find cancer at an earlier, more treatable stage. (See “For women who are or may be at increased risk” in the section “Can breast cancer be prevented?”)

Mutations in tumor suppressor genes like the *BRCA* genes are considered “high-penetrance” because they often lead to cancer. Although many of the women with high-penetrance mutations develop cancer, most cases of cancer (including breast cancer) are not caused by this kind of mutation. More often, low-penetrance mutations or gene variations are a factor in cancer development. Each of these may have a small individual effect on cancer development, but the overall effect on the population can be large because they are common, and people often are affected with more than one at the same time. The genes involved may affect things like hormone levels, metabolism or other things that interact with risk factors for breast cancer. These genes may be responsible for much of the risk of breast cancer that runs in families.

## Acquired gene mutations

Most DNA mutations related to breast cancer occur in single breast cells during a woman's life rather than having been inherited. These *acquired* mutations of oncogenes and/or tumor suppressor genes may result from other factors, like radiation or cancer-causing chemicals. But so far, the causes of most acquired mutations that could lead to breast cancer are still unknown. Most breast cancers have several acquired gene mutations.

Tests to spot acquired gene changes may help doctors more accurately predict the outlook for some women with breast cancer. For example, tests can identify women whose breast cancer cells have too many copies of the *HER2* oncogene. These cancers tend to be more aggressive. At the same time, drugs have been developed that specifically target these cancers and improve outcomes for patients.

For more information about how genes can affect cancer risk and treatment, see our document *Genes and Cancer*.

## Can breast cancer be prevented?

There is no sure way to prevent breast cancer. But there are things you can do that might lower your risk., such as changing risk factors that are under your control. (See the section “What are the risk factors for breast cancer?”)

For example, body weight, physical activity, and diet have all been linked to breast cancer, so these might be areas where you can take action. This is discussed in more

detail in our document *American Cancer Society Guidelines on Nutrition and Physical Activity for Cancer Prevention*.

Taking a drug to lower your breast cancer risk may also be an option. This is discussed in more detail in our document *Medicines to Reduce Breast Cancer Risk*.

If you have a strong family history of breast cancer, you can talk to your doctor about genetic testing for mutations in genes that increase the risk of breast cancer, such as the *BRCA* genes. If you have such a mutation or come from a family with a mutation but haven't been tested, you could consider surgery to lower your risk of cancer.

Our document *Breast Cancer Prevention and Early Detection* has more detailed information about ways to lower your risk of breast cancer.

## **Can breast cancer be found early?**

Screening refers to tests and exams used to find a disease, like cancer, in people who do not have any symptoms. The goal of screening exams, such as mammograms, is to find cancers before they start to cause symptoms. Breast cancers that are found because they can be felt tend to be larger and are more likely to have already spread beyond the breast. But screening exams can often find breast cancers when they are small and still confined to the breast.

The mammogram and clinical breast exam are the main tests recommended by the American Cancer Society to find breast cancer early. For women who are at high risk of breast cancer due to certain factors, the American Cancer Society also recommends breast MRI.

Our document *Breast Cancer Prevention and Early Detection* has more details about the American Cancer Society guidelines for the early detection of breast cancer.

## **Signs and symptoms of breast cancer**

Widespread use of screening mammograms has increased the number of breast cancers found before they cause any symptoms. Still, some breast cancers are not found by mammogram, either because the test was not done or because, even under ideal conditions, mammograms do not find every breast cancer.

The most common symptom of breast cancer is a new lump or mass. A painless, hard mass that has irregular edges is more likely to be cancerous, but breast cancers can be tender, soft, or rounded. They can even be painful. For this reason, it is important to have any new breast mass or lump or breast change checked by a health care professional experienced in diagnosing breast diseases.

Other possible symptoms of breast cancer include:

- Swelling of all or part of a breast (even if no distinct lump is felt)
- Skin irritation or dimpling
- Breast or nipple pain
- Nipple retraction (turning inward)
- Redness, scaliness, or thickening of the nipple or breast skin
- Nipple discharge (other than breast milk)

Sometimes a breast cancer can spread to lymph nodes under the arm or around the collar bone and cause a lump or swelling there, even before the original tumor in the breast tissue is large enough to be felt. Swollen lymph nodes should also be reported to your doctor.

Although any of these symptoms can be caused by things other than breast cancer, if you have them, they should be reported to your doctor so that he or she can find the cause.

## **How is breast cancer diagnosed?**

Breast cancer is sometimes found after symptoms appear, but many women with early breast cancer have no symptoms. This is why getting the recommended screening tests (as described in the section "Can breast cancer be found early?") before any symptoms develop is so important.

If something suspicious is found during a screening exam, or if you have any of the symptoms of breast cancer described in the previous section, your doctor will use one or more methods to find out if the disease is present. If cancer is found, other tests will be done to determine the stage (extent) of the cancer.

### **Medical history and physical exam**

If you think you have any signs or symptoms that might mean breast cancer, be sure to see your doctor as soon as possible. Your doctor will ask you questions about your symptoms, any other health problems, and possible risk factors for benign breast conditions or breast cancer.

Your breasts will be thoroughly examined for any lumps or suspicious areas and to feel their texture, size, and relationship to the skin and chest muscles. Any changes in the nipples or the skin of your breasts will be noted. The lymph nodes in your armpit and above your collarbones may be palpated (felt), because enlargement or firmness of these lymph nodes might indicate spread of breast cancer. Your doctor will also do a complete physical exam to judge your general health and whether there is any evidence of cancer that may have spread.

If breast symptoms and/or the results of your physical exam suggest breast cancer might be present, more tests will probably be done. These might include imaging tests, looking at samples of nipple discharge, or doing biopsies of suspicious areas.

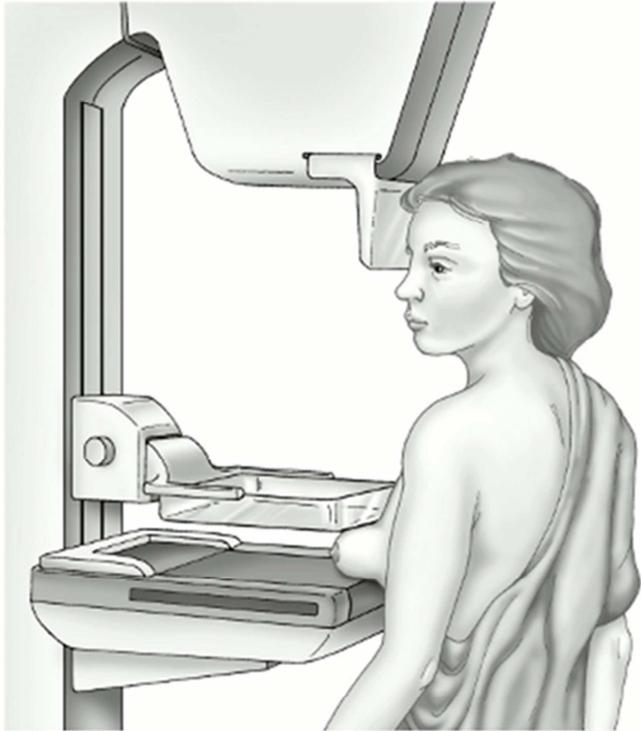
## Imaging tests used to evaluate breast disease

Imaging tests use x-rays, magnetic fields, sound waves, or radioactive substances to create pictures of the inside of your body. Imaging tests may be done for a number of reasons, including to help find out whether a suspicious area might be cancerous, to learn how far cancer may have spread, and to help determine if treatment is working.

### **Mammograms**

A mammogram is an x-ray of the breast. Screening mammograms are used to look for breast disease in women who have no signs or symptoms of a breast problem. Screening mammograms usually take 2 views (x-ray pictures taken from different angles) of each breast.

For a mammogram, the breast is pressed between 2 plates to flatten and spread the tissue. This may be uncomfortable for a moment, but it is necessary to produce a good, readable mammogram. The compression only lasts a few seconds.



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## Mammogram

If you have breast symptoms (like a lump or nipple discharge) or an abnormal result on a screening mammogram, you will have a diagnostic mammogram. This will include more images of the area of concern.

If your diagnostic mammogram shows that the abnormal area is more suspicious for cancer, a biopsy will be needed to tell if it is cancer.

Even if the mammograms show no tumor, if you or your doctor can feel a lump, a biopsy is usually needed to make sure it isn't cancer. One exception would be if an ultrasound exam finds that the lump is a simple cyst (a fluid-filled sac), which is very unlikely to be cancerous.

If cancer is found, a diagnostic mammogram is often done to get more thorough views of both breasts. This is to check for any other abnormal areas that could be cancer as well.

Our document *Mammograms and Other Breast Imaging Tests* has more detailed information about mammograms.

## Breast ultrasound

Ultrasound, also known as *sonography*, uses sound waves to outline a part of the body. For this test, a small, microphone-like instrument called a *transducer* is placed on the

skin (which is often first lubricated with ultrasound gel). It emits sound waves and picks up the echoes as they bounce off body tissues. The echoes are converted by a computer into a black and white image that is displayed on a computer screen. This test is painless and does not expose you to radiation.

Ultrasound has become a valuable tool to use along with mammography because it is widely available and less expensive than other options, such as MRI. Usually, breast ultrasound is used to target a specific area of concern found on the mammogram. Ultrasound helps distinguish between cysts (fluid-filled sacs) and solid masses and sometimes can help tell the difference between benign and cancerous tumors. In someone with a breast tumor, it can also be used to look for enlarged lymph nodes under the arm.

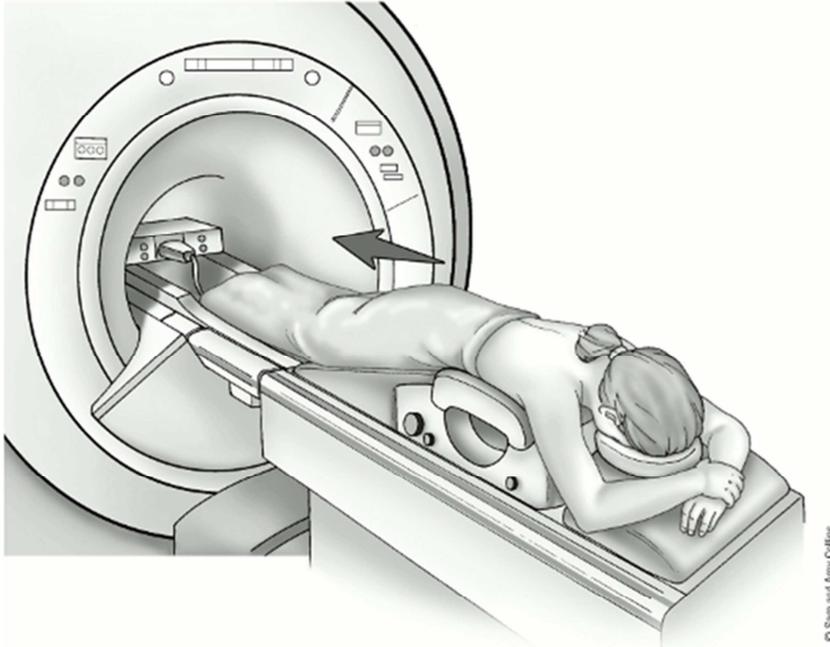
The use of ultrasound instead of mammograms for breast cancer screening is not recommended. However, clinical trials are now looking at the benefits and risks of adding breast ultrasound to screening mammograms in women with dense breasts and a higher risk of breast cancer.

Our document *Mammograms and Other Breast Imaging Tests* has more detailed information about breast ultrasound.

## **Magnetic resonance imaging (MRI) of the breast**

MRI scans use radio waves and strong magnets instead of x-rays. The energy from the radio waves is absorbed and then released in a pattern formed by the type of body tissue and by certain diseases. A computer translates the pattern into a very detailed image. For breast MRI to look for cancer, a contrast liquid called *gadolinium* is injected into a vein before or during the scan to show details better.

MRI scans can take a long time – often up to an hour. For a breast MRI, you have to lie inside a narrow tube, face down on a platform specially designed for the procedure. The platform has openings for each breast that allow them to be imaged without compression. The platform contains the sensors needed to capture the MRI image. It is important to remain very still throughout the exam.



## Breast MRI

MRI can be used along with mammograms for screening women who have a high risk of developing breast cancer, or it can be used to better examine suspicious areas found by a mammogram. MRI is also sometimes used for women who have been diagnosed with breast cancer to better determine the actual size of the cancer and to look for any other cancers in the breast. It is not yet clear how helpful this is in planning surgery in someone known to have breast cancer. In someone known to have breast cancer, it is sometimes used to look at the opposite breast, to be sure that it does not contain any tumors.

If an abnormal area in the breast is found, it can often be biopsied using an MRI for guidance. This is discussed in more detail in the "Biopsy" section.

Our document *Mammograms and Other Breast Imaging Tests* has more detailed information about breast MRI.

## Other tests

These tests may be done for the purposes of research, but they have not yet been found to be helpful in diagnosing breast cancer in most women.

### **Nipple discharge exam**

If you are having nipple discharge, some of the fluid may be collected and looked at under a microscope to see if any cancer cells are in it. Most nipple discharges or secretions are not cancer. In general, if the secretion appears milky or clear green, cancer

is very unlikely. If the discharge is red or red-brown, suggesting that it contains blood, it might possibly be caused by cancer, although an injury, infection, or benign tumors are more likely causes.

Even when no cancer cells are found in a nipple discharge, doctors cannot be sure breast cancer is not present. If you have a suspicious mass, it will be necessary to biopsy the mass, even if the nipple discharge does not contain cancer cells.

## **Ductal lavage and nipple aspiration**

Ductal lavage is an experimental test developed for women who have no symptoms of breast cancer but are at very high risk for the disease. It is not a test to screen for or diagnose breast cancer, but it may help give a more accurate picture of a woman's risk of developing it.

Ductal lavage can be done in a doctor's office or an outpatient facility. An anesthetic cream is applied to numb the nipple area. Gentle suction is then used to help draw tiny amounts of fluid from the milk ducts up to the nipple surface, which helps locate the ducts' natural openings. A tiny tube (called a *catheter*) is then inserted into a duct opening. Saline (salt water) is slowly infused into the catheter to gently rinse the duct and collect cells. The ductal fluid is drawn through the catheter and sent to a lab, where the cells are looked at under a microscope.

Ductal lavage is not done if a woman isn't at high risk for breast cancer. It is not clear if it will ever be useful. The test has not been shown to detect cancer early. It is more likely to be helpful as a test of cancer risk rather than as a screening test for cancer. More studies are needed to better define the usefulness of this test.

Nipple aspiration also looks for abnormal cells developing in the ducts, but is much simpler, because nothing is inserted into the breast. The device for nipple aspiration uses small cups that are placed on the woman's breasts. The device warms the breasts, gently compresses them, and applies light suction to bring nipple fluid to the surface of the breast. The nipple fluid is then collected and sent to a lab for analysis. As with ductal lavage, the procedure may be useful as a test of cancer risk but is not an appropriate screening test for cancer. The test has not been shown to detect cancer early.

## **Biopsy**

A biopsy is done when mammograms, other imaging tests, or the physical exam finds a breast change (or abnormality) that is possibly cancer. A biopsy is the only way to tell if cancer is really present.

During a biopsy, a sample of the suspicious area is removed to be looked at under a microscope, by a specialized doctor with many years of training called a *pathologist*. The pathologist sends your doctor a report that gives a diagnosis for each sample taken.

Information in this report will be used to help manage your care. For information to help you understand your pathology report, see the “Breast Pathology” section of our website or call 1-800-227-2345.

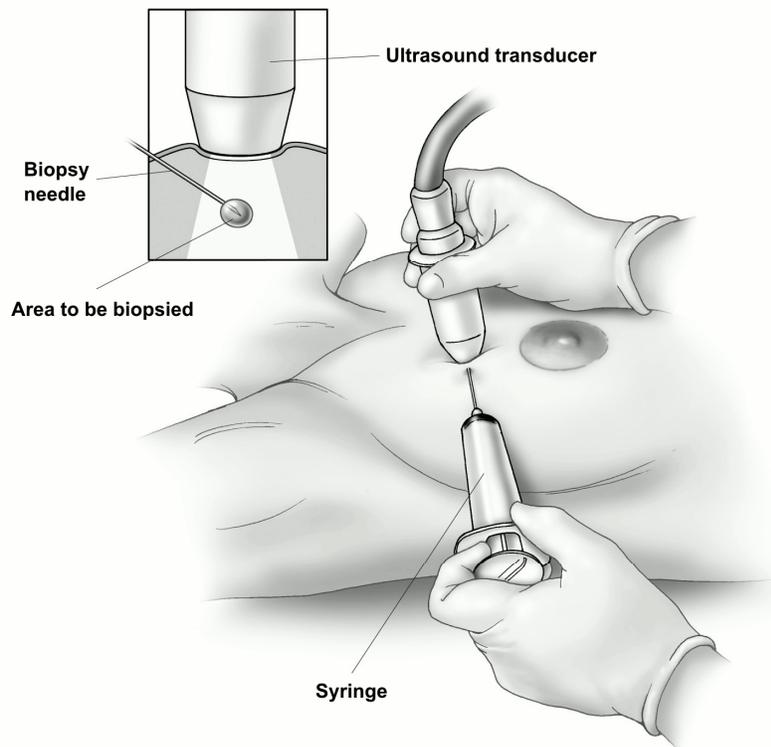
There are several types of biopsies, such as fine needle aspiration biopsy, core (large needle) biopsy, and surgical biopsy. Each has its pros and cons. The choice of which to use depends on your specific situation. Some of the factors your doctor will consider include how suspicious the lesion appears, how large it is, where in the breast it is located, how many lesions are present, other medical problems you might have, and your personal preferences. You might want to discuss the pros and cons of different biopsy types with your doctor.

Often, after the tissue sample is removed, the doctor will place a tiny metal clip or marker inside the breast at the biopsy site. The clip cannot be felt and should not cause any problems, but it is helpful in finding the area again on future mammograms and for surgery. Some patients who have cancer are given chemotherapy or other treatments before surgery that can shrink the tumor so much that it can't be felt or seen on mammogram. The clip can be used to direct the surgeon to the area where the tumor was so the correct area of the breast can be removed.

### **Fine needle aspiration biopsy**

In a fine needle aspiration (FNA) biopsy, the doctor uses a very thin, hollow needle attached to a syringe to withdraw (aspirate) a small amount of tissue from a suspicious area, which is then looked at under a microscope. The needle used for an FNA biopsy is thinner than the one used for blood tests.

If the area to be biopsied can be felt, the needle can be guided into the area of the breast change while the doctor is feeling (palpating) it.



### Fine needle aspiration using ultrasound

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If the lump can't be felt easily, the doctor might use ultrasound to watch the needle on a screen as it moves toward and into the mass.

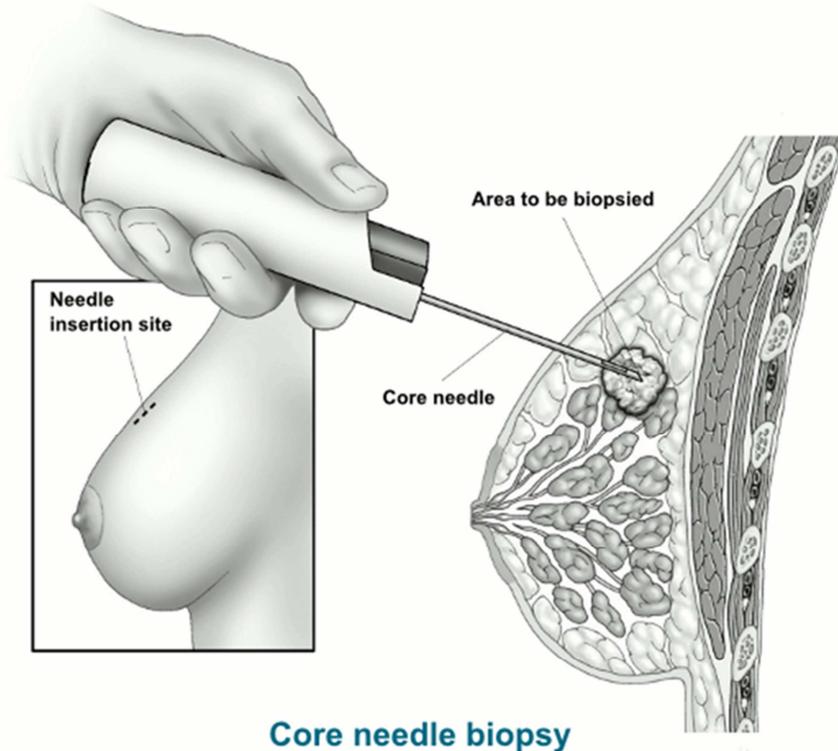
A local anesthetic (numbing medicine) may or may not be used. Because such a thin needle is used for the biopsy, the process of getting the anesthetic may actually be more uncomfortable than the biopsy itself.

Once the needle is in place, fluid is drawn out. If the fluid is clear, the lump is probably a benign cyst. Bloody or cloudy fluid can mean either a benign cyst or, very rarely, a cancer. If the lump is solid, small tissue fragments are drawn out. A pathologist will look at the biopsy tissue or fluid under a microscope to determine if it is cancerous.

An FNA biopsy is the easiest type of biopsy to have, but it has some disadvantages. It can sometimes miss a cancer if the needle is not placed among the cancer cells. And even if cancer cells are found, it is usually not possible to determine if the cancer is invasive. In some cases there may not be enough cells to perform some of the other lab tests that are routinely done on breast cancer specimens. If the FNA biopsy does not provide a clear diagnosis, or your doctor is still suspicious, a second biopsy or a different type of biopsy should be done.

## Core needle biopsy

A core biopsy uses a larger needle to sample breast changes felt by the doctor or pinpointed by ultrasound or mammogram.



When mammograms taken from different angles are used to pinpoint the biopsy site, this is known as a stereotactic core needle biopsy.

In some centers, the biopsy can be guided by an MRI scan.

The needle used in core biopsies is larger than the one used in FNA. It removes a small cylinder (core) of tissue (about 1/16- to 1/8-inch in diameter and 1/2-inch long) from a breast abnormality. Several cores are often removed. The biopsy is done using local anesthesia (you are awake but the area is numbed) in an outpatient setting.

Because it removes larger pieces of tissue, a core needle biopsy is more likely than an FNA to provide a clear diagnosis, although it might still miss some cancers.

### Vacuum-assisted core biopsies

Another way to do a core biopsy is known as vacuum-assisted. For this procedure, the skin is numbed and a small incision (about 1/4 inch) is made. A hollow probe is inserted through the incision into the abnormal area of breast tissue. The probe is guided into place using mammography, ultrasound, or MRI. A cylinder of tissue is then suctioned in

through a hole in the side of the probe, and a rotating knife within the probe cuts the tissue sample from the rest of the breast. Several samples can be taken from the same incision. Vacuum-assisted biopsies are done as an outpatient procedure. No stitches are needed, and there is minimal scarring. This method usually removes more tissue than a regular core biopsy.

## **Surgical (open) biopsy**

Usually, breast cancer can be diagnosed using needle biopsy. Rarely, surgery is needed to remove all or part of the lump for microscopic examination. This is referred to as a *surgical biopsy* or an *open biopsy*. Most often, the surgeon removes the entire mass or abnormal area as well as a surrounding margin of normal-appearing breast tissue. This is called an *excisional biopsy*. If the mass is too large to be removed easily, only part of it may be removed. This is called an *incisional biopsy*.

In rare cases, a surgical biopsy can be done in the doctor's office, but it is most often done in the hospital's outpatient department under local anesthesia (you are awake, but your breast is numbed), often with intravenous sedation (medicine given to make you drowsy). This type of biopsy can also be done under general anesthesia (you are asleep).

If the breast change cannot be felt, a mammogram may be used to place a wire into the correct area to guide the surgeon. This technique is called *wire localization* or *stereotactic wire localization*. After the area is numbed with local anesthetic, a thin hollow needle is placed in the breast, and x-ray views are used to guide the needle to the suspicious area. Once the tip of the needle is in the right spot, a thin wire is inserted through the center of the needle. A small hook at the end of the wire keeps it in place. The hollow needle is then removed. The surgeon can then use the wire as a guide to the abnormal area to be removed. The surgical specimen is sent to the lab to be looked at under a microscope (see below).

A surgical biopsy is more involved than an FNA biopsy or a core needle biopsy. It typically requires several stitches and may leave a scar. The larger the amount of tissue removed, the more likely it is that you will notice a change in the shape of your breast afterward.

Core needle biopsy is usually enough to make a diagnosis, but sometimes an open biopsy may be needed depending on where the lesion is, or if a core biopsy is not conclusive.

All biopsies can cause bleeding and can lead to swelling. This can make it seem like the breast lump is larger after the biopsy. This is generally nothing to worry about and the bleeding and bruising resolve quickly in most cases.

## **Lymph node biopsy**

If the lymph nodes under the arm are enlarged (either by feel or on an imaging test like mammography or ultrasound), they may be checked for cancer spread. Most often, a needle biopsy is done at the time of the needle biopsy of the breast tumor.

Even if no lymph nodes are enlarged, the lymph nodes under the arm are usually checked for cancer spread when the breast tumor is removed at surgery. This is done with a sentinel lymph node biopsy and/or an axillary lymph node dissection. These procedures are described in detail in the section "How is breast cancer treated?"

## **How is breast cancer classified?**

After you have a biopsy, the samples of breast tissue are looked at in the lab to determine whether breast cancer is present and if so, what type it is. Certain lab tests may be done that can help determine how quickly a cancer is likely to grow and (to some extent) what treatments are likely to be effective. Sometimes these tests aren't done until the entire tumor is removed by either breast-conserving surgery or mastectomy.

If a benign condition is diagnosed, you will need no further treatment. Still, it is important to find out from your doctor if the benign condition puts you at higher risk for breast cancer in the future and what type of follow-up you might need.

If the diagnosis is cancer, there should be time for you to learn about the disease and to discuss treatment options with your cancer care team, friends, and family. It is usually not necessary to rush into treatment. You might want to get a second opinion before deciding what treatment is best for you.

## **Breast cancer type**

The tissue removed during the biopsy (or during surgery) is first looked at under a microscope to see if cancer is present and whether it is a carcinoma or some other type of cancer (like a sarcoma). If there is enough tissue, the pathologist may be able to determine if the cancer is in situ (not invasive) or invasive. The biopsy is also used to determine the cancer's type, such as invasive ductal carcinoma or invasive lobular carcinoma. See "What is breast cancer?" for more about each type.

With an FNA biopsy, not as many cells are removed and they often become separated from the rest of the breast tissue, so it is often only possible to say that cancer cells are present without being able to say if the cancer is in situ or invasive.

The most common types of breast cancer, invasive ductal and invasive lobular cancer, generally are treated in the same way.

## Breast cancer grade

A pathologist also assigns a grade to the cancer, which is based on how closely the biopsy sample looks to normal breast tissue and how rapidly the cancer cells are dividing. The grade can help predict a woman's prognosis. In general, a lower grade number indicates a slower-growing cancer that is *less* likely to spread, while a higher number indicates a faster-growing cancer that is *more* likely to spread. The tumor grade is one factor in deciding if further treatment is needed after surgery.

For invasive cancers, the histologic tumor grade sometimes called the *Bloom-Richardson grade*, *Nottingham grade*, *Scarff-Bloom-Richardson grade*, or *Elston-Ellis grade*. Sometimes the grade is expressed with words instead of numbers:

- Grade 1 is the same as well differentiated
- Grade 2 is the same as moderately differentiated.
- Grade 3 is the same as poorly differentiated

Grade 3 cancers tend to grow and spread more quickly.

Our document *Understanding Your Pathology Report: Breast Cancer* has more information about grading invasive cancers.

DCIS is also graded, but the grade is based only on how abnormal the cancer cells appear (nuclear grade). The presence of necrosis (areas of dead or dying cancer cells) is also noted. The term *comedocarcinoma* is often used to describe DCIS with prominent necrosis. If a breast duct is filled with a plug of dead and dying cells, the term *comedonecrosis* may be used. The terms *comedocarcinoma* and *comedonecrosis* are linked to a higher grade of DCIS.

Our document *Understanding Your Pathology Report: Ductal Carcinoma In Situ* has more information.

## Tests to classify breast cancers

### **Estrogen receptor (ER) and progesterone receptor (PR)**

Receptors are proteins in or on certain cells that can attach to certain substances, such as hormones, that circulate in the blood. Normal breast cells and some breast cancer cells contain receptors that attach to estrogen and progesterone. These 2 hormones often fuel the growth of breast cancer cells.

An important step in evaluating a breast cancer is to test a portion of the cancer removed during the biopsy (or surgery) to see if they have estrogen and progesterone receptors. Cancer cells may contain neither, one, or both of these receptors. Breast cancers that have

estrogen receptors are often referred to as *ER-positive* (or ER+) cancers, while those containing progesterone receptors are called *PR-positive* (or PR+) cancers.

All invasive breast cancers should be tested for both of these hormone receptors either on the biopsy sample or when they are removed with surgery. About 2 of 3 breast cancers have at least one of these receptors. This percentage is higher in older women than in younger women. DCIS should be checked for estrogen receptors, as well.

## **HER2/neu testing**

About 1 of 5 breast cancers have too much of a growth-promoting protein called HER2/neu (often just shortened to HER2). The *HER2/neu* gene instructs the cells to make this protein. Tumors with increased levels of HER2/neu are referred to as *HER2-positive*.

Cancers that are HER2-positive have too many copies of the *HER2/neu gene*, resulting in greater than normal amounts of the HER2/neu protein. These cancers tend to grow and spread more aggressively than other breast cancers.

All newly diagnosed invasive breast cancers should be tested for HER2/neu because HER2-positive cancers are much more likely to benefit from treatment with drugs that target the HER2/neu protein, such as trastuzumab (Herceptin<sup>®</sup>) and lapatinib (Tykerb<sup>®</sup>). DCIS is not tested for HER2 because it is not treated with these drugs.

A biopsy or surgery sample is usually tested in 1 of 2 ways:

- Immunohistochemistry (IHC): In this test, special antibodies that identify the HER2/neu protein are applied to the sample, which cause cells to change color if many copies are present. This color change can be seen under a microscope. The test results are reported as 0, 1+, 2+, or 3+.
- Fluorescent in situ hybridization (FISH): This test uses fluorescent pieces of DNA that specifically stick to copies of the *HER2/neu* gene in cells, which can then be counted under a special microscope.

Many breast cancer specialists feel the FISH test is more accurate than IHC. However, it is more expensive and takes longer to get the results. Often the IHC test is used first. If the results are 1+ (or 0), the cancer is considered HER2-negative. People with HER2-negative tumors are not treated with drugs (like trastuzumab) that target HER2. If the test comes back 3+, the cancer is HER2-positive. Patients with HER2-positive tumors may be treated with drugs like trastuzumab. When the result is 2+, the HER2 status of the tumor is not clear. This usually leads to testing the tumor with FISH. Some institutions also use FISH to confirm HER2 status that is 3+ by IHC and some perform only FISH.

A newer type of test, known as *chromogenic in situ hybridization (CISH)*, works similarly to FISH, by using small DNA probes to count the number of *HER2* genes in

breast cancer cells. But this test looks for color changes (not fluorescence) and doesn't require a special microscope, which could make it less expensive. Right now, it is not being used as much as IHC or FISH.

## **Classifying breast cancer based on hormone receptors and HER2 status**

Doctors often divide invasive breast cancers into groups based on the presence of hormone receptors (ER and PR) and whether or not the cancer has too much HER2.

**Hormone receptor-positive:** If the breast cancer cells contain either estrogen or progesterone receptors, they can be called hormone receptor-positive (or just hormone-positive). Breast cancers that are hormone receptor-positive can be treated with hormone therapy drugs that lower estrogen levels or block estrogen receptors. This includes cancers that are ER-negative but PR-positive. Hormone receptor-positive cancers tend to grow more slowly than those that are hormone receptor-negative (and don't have either estrogen or progesterone receptors). Women with these cancers tend to have a better outlook in the short-term, but cancers that are hormone receptor-positive can sometimes come back many years after treatment. Hormone receptor-positive cancers are more common in women after menopause.

**Hormone receptor-negative:** If the breast cancer cells don't have either estrogen or progesterone receptors, they are said to be hormone receptor-negative (or just hormone-negative). Treatment with hormone therapy drugs is not helpful for these cancers. These cancers tend to grow more quickly than hormone receptor-positive cancers. If they return after treatment, it is more often in the first few years. Hormone receptor-negative cancers are more common in women who have not yet gone through menopause.

**HER2 positive:** Cancers that have too much HER2 protein or extra copies of the HER2 gene are called HER2 positive. These cancers can be treated with drugs that target HER2.

**HER2 negative:** Cancers that don't have excess HER2 are called HER2 negative. These cancers do not respond to treatment with drugs that target HER2.

**Triple-negative:** If the breast cancer cells don't have estrogen or progesterone receptors and don't have too much HER2, they are called triple-negative. These cancers tend to occur more often in younger women and in women who are African-American or Hispanic/Latina. Triple-negative breast cancers tend to grow and spread more quickly than most other types of breast cancer. Because the tumor cells don't have hormone receptors, hormone therapy is not helpful in treating these cancers. Because they don't have too much HER2, drugs that target HER2 aren't helpful, either. Chemotherapy can still be useful, though.

**Triple-positive:** This term is used to describe cancers that are ER-positive, PR-positive, and have too much HER2. These cancers can be treated with hormone drugs as well as drugs that target HER2.

## Other tests of breast cancers

### Tests of ploidy and cell proliferation rate

The ploidy of cancer cells refers to the amount of DNA they contain. If there's a normal amount of DNA in the cells, they are said to be *diploid*. If the amount is abnormal, then the cells are described as *aneuploid*. Tests of ploidy may help determine prognosis, but they rarely change treatment and are considered optional. They are not usually recommended as part of a routine breast cancer work-up.

The *S-phase fraction* is the percentage of cells in a sample that are replicating (copying) their DNA. DNA replication means that the cell is getting ready to divide into 2 new cells. The rate of cancer cell division can also be estimated by a Ki-67 test. If the S-phase fraction or Ki-67 labeling index is high, it means that the cancer cells are dividing more rapidly, which indicates a more aggressive cancer.

### Tests of gene patterns

Researchers have found that looking at the patterns of a number of different genes at the same time (sometimes referred to as *gene expression profiling*) can help predict whether or not an early-stage breast cancer is likely to come back after initial treatment. Two such tests, which look at different sets of genes, are now available: the Oncotype DX<sup>®</sup> and the MammaPrint<sup>®</sup>

**Oncotype DX<sup>®</sup>:** The Oncotype DX test can be helpful when deciding whether additional (adjuvant) treatment with chemotherapy (after surgery) might be useful in women with early-stage breast cancers that are hormone receptor-positive. This test is most often used for tumors that are small (1 cm or less) and have not spread to lymph nodes, but it can be used for more advanced tumors.

The test looks at a set of 21 genes in cells from tumor samples to determine a “recurrence score,” which is a number between 0 and 100:

- Cancers with a recurrence score of 17 or below have a low risk of recurrence (cancer coming back after treatment) if they are treated with hormone therapy. Women with these cancers would probably not benefit from chemotherapy.
- Cancers with a score of 18 to 30 are at intermediate risk of recurrence. Some women with these cancer might benefit from chemotherapy.
- Cancers with a score of 31 or more are at high risk of recurrence. Women with these cancers are likely to benefit from chemotherapy in addition to hormone therapy.

The test estimates risk and helps predict who would be likely to benefit from chemotherapy. Still, it cannot tell for certain if any particular woman will have a recurrence with or without chemotherapy. It is a tool that can be used, along with other

factors, to help guide women and their doctors when deciding whether more treatment might be useful.

**MammaPrint®:** This test can be used to help determine how likely breast cancers are to recur in a distant part of the body after initial treatment.

The test looks at the activity of 70 different genes to determine if the cancer is low risk or high risk. So far though, it hasn't been studied to see if the results are useful in guiding treatment.

**Usefulness of these tests:** Many doctors use these tests (along with other information) to help make decisions about offering chemotherapy, but they aren't needed in all cases. These tests are now being looked at further in large clinical trials. In the meantime, women might want to ask their doctors if these tests might be useful for them.

## Classifying breast cancer based on gene expression

Research on patterns of gene expression has also suggested some newer ways to classify breast cancers. The current types of breast cancer are based largely on how tumors look under a microscope. A newer classification, based on molecular features, divides breast cancers into 4 groups. This testing, called the *PAM50*, is currently available but it isn't clear that it is any more helpful in guiding treatment than tests of hormone receptors and HER2:

**Luminal A and luminal B types:** The luminal types are estrogen receptor (ER)-positive. The gene expression patterns of these cancers are similar to normal cells that line the breast ducts and glands (the inside of a duct or gland is called its *lumen*). Luminal A cancers are low grade, tend to grow fairly slowly, and have the best prognosis. Luminal B cancers generally grow somewhat faster than luminal A cancers and their outlook is not as good.

**HER2 type:** These cancers have extra copies of the *HER2* gene and sometimes some others. They usually have a high-grade appearance under the microscope. These cancers tend to grow more quickly and have a worse prognosis, although they often can be treated successfully with targeted therapies aimed at HER2 which are often given along with chemotherapy.

**Basal type:** Most of these cancers are of the so-called *triple-negative* type, that is, they lack estrogen or progesterone receptors and have normal amounts of HER2. The gene expression patterns of these cancers are similar to cells in the deeper basal layers of breast ducts and glands. This type is more common among women with *BRCA1* gene mutations. For reasons that are not well understood, this cancer is also more common among younger and African-American women.

These are high-grade cancers that tend to grow quickly and have a poor outlook. Hormone therapy and anti-HER2 therapies like trastuzumab and lapatinib are not

effective against these cancers, although chemotherapy can be helpful. A great deal of research is being done to find better ways to treat these cancers.

It is hoped that these new breast cancer classifications might someday allow doctors to better tailor breast cancer treatments, but more research is needed in this area before this will be possible.

## More on testing biopsy tissue to classify cancer

For more information on how biopsy tissue is looked at and tested by pathologists, see our document *Testing Biopsy and Cytology Specimens for Cancer*.

## Looking for breast cancer spread

Once breast cancer is diagnosed, one or more of the following tests may be done. These tests aren't often done for early breast cancer. Which tests (if any) are done depends on how likely it is the cancer has spread, based on the size of the tumor, the presence of lymph node spread, and any symptoms you are having.

### Chest x-ray

This test may be done to see whether the breast cancer has spread to your lungs.

### Bone scan

A bone scan can help show if a cancer has spread (metastasized) to your bones. It can be more useful than standard x-rays because it can show all of the bones of the body at the same time and can find small areas of cancer spread not seen on plain x-rays.

For this test, a small amount of low-level radioactive material is injected into a vein (intravenously, or IV). The substance settles in areas of bone changes throughout the entire skeleton in a couple of hours. You then lie on a table for about 30 minutes while a special camera detects the radioactivity and creates a picture of your skeleton.

Areas of bone changes appear as "hot spots" on your skeleton—that is, they attract the radioactivity. These areas may suggest the presence of metastatic cancer, but arthritis or other bone diseases can also cause the same pattern. To distinguish between these conditions, your cancer care team may use other imaging tests such as simple x-rays or CT or MRI scans to get a better look at the areas that light up, or they may even take biopsy samples of the bone.

## Computed tomography (CT) scan

The CT scan is an x-ray test that produces detailed cross-sectional images of your body. Instead of taking one picture, like a regular x-ray, a CT scanner takes many pictures as it rotates around you while you lie on a table. A computer then combines these pictures into images of slices of the part of your body being studied. In women with breast cancer, this test is most often used to look at the chest and/or abdomen to see if the cancer has spread to other organs such as the lungs or liver.

A CT scanner has been described as a large donut, with a narrow table in the middle opening. You will need to lie still on the table while the scan is being done. CT scans take longer than regular x-rays, and you might feel a bit confined by the ring while the pictures are being taken.

Before the test, you may be asked to drink 1 to 2 pints of a liquid called *oral contrast*. This helps outline the intestine so that certain areas are not mistaken for tumors. You may also receive an IV (intravenous) line through which a different kind of contrast dye (IV contrast) is injected. This helps better outline structures in your body.

The injection might cause some flushing (a feeling of warmth, especially in the face). Some people are allergic and get hives. Rarely, more serious reactions like trouble breathing or low blood pressure can occur. Medicine can be given to prevent and treat allergic reactions. Be sure to tell the doctor if you have ever had a reaction to any contrast material used for x-rays.

**CT guided needle biopsy:** If an abnormality is seen on a CT scan, but it is not clear if it is cancer, it may need to be biopsied. The CT scan can guide a biopsy needle precisely into a suspected area of cancer spread. For this procedure, you stay on the CT scanning table while a radiologist advances a biopsy needle through the skin and toward the location of the mass. CT scans are repeated until the doctors are sure that the needle is within the mass. The biopsy sample is then removed and sent to be looked at under a microscope.

## Magnetic resonance imaging (MRI) scan

MRI scans use radio waves and strong magnets instead of x-rays to take pictures of the body. See “Can breast cancer be found early?” for more about getting an MRI of the breast.

MRI scans are also used to look for cancer that has spread to various parts of the body, just like CT scans. MRI scans are particularly helpful in looking at the brain and spinal cord.

There are some differences in getting an MRI of areas other than your breast. You will lie face up in the machine, and the contrast material called *gadolinium* might not be needed. Also, you might have the option of having the scan in a less confining "open" MRI

machine. The images from an open machine are not always as good, though, so this might not always be an option.

## Ultrasound

The use of this test to look at the breast was discussed in the section “How is breast cancer diagnosed?” But ultrasound can also be used to look for cancer that has spread to some other parts of the body.

Abdominal ultrasound can be used to look for tumors in your liver or other abdominal organs. When you have an abdominal ultrasound exam, you simply lie on a table and a technician moves the transducer on the skin over the part of your body being examined. Usually, the skin is first lubricated with gel.

## Positron emission tomography (PET) scan

For a PET scan, glucose (a form of sugar) that contains a radioactive atom is injected into the bloodstream. Because cancer cells grow rapidly, they absorb large amounts of the radioactive sugar. After about an hour, a special camera is used to create a picture of areas of radioactivity in the body.

A PET scan is useful when your doctor thinks the cancer might have spread but doesn't know where. The picture is not finely detailed like a CT or MRI scan, but it provides helpful information about your whole body. Some machines are able to do both a PET and CT scan at the same time (PET/CT scan). This lets the radiologist compare areas of higher radioactivity on the PET with the appearance of that area on the CT. This is the most common type of PET scan used for women with breast cancer.

So far, most studies show PET scans aren't very helpful in early breast cancer, but they may be used for very large tumors, inflammatory breast cancer, or for breast cancers that are known to have spread.

## How is breast cancer staged?

The stage describes the extent of the cancer in the body. It is based on whether the cancer is invasive or non-invasive, the size of the tumor, how many lymph nodes are involved, and if it has spread to other parts of the body. The cancer's stage is one of the most important factors in determining prognosis and treatment options.

Staging is the process of finding out how widespread a cancer is when it is diagnosed. Depending on the results of your physical exam and biopsy, your doctor may want you to have certain imaging tests such as a chest x-ray, mammograms of both breasts, bone scans, computed tomography (CT) scans, magnetic resonance imaging (MRI), and/or

positron emission tomography (PET) scans. Blood tests may also be done to evaluate your overall health and sometimes can indicate if the cancer has spread to certain organs.

## The American Joint Committee on Cancer (AJCC) TNM system

A staging system is a standardized way for the cancer care team to summarize information about how far a cancer has spread. The most common system used to describe the stages of breast cancer is the American Joint Committee on Cancer (AJCC) TNM system.

The stage of a breast cancer can be based either on the results of physical exam, biopsy, and imaging tests (called the *clinical stage*), or on the results of these tests plus the results of surgery (called the *pathologic stage*). The staging described here is the pathologic stage, which includes the findings after surgery, when the pathologist has looked at the breast mass and nearby lymph nodes. Pathologic staging is likely to be more accurate than clinical staging, as it allows the doctor to get a firsthand impression of the extent of the cancer.

The TNM staging system classifies cancers based on their T, N, and M stages:

- The letter T followed by a number from 0 to 4 describes the tumor's size and spread to the skin or to the chest wall under the breast. Higher T numbers mean a larger tumor and/or wider spread to tissues near the breast.
- The letter N followed by a number from 0 to 3 indicates whether the cancer has spread to lymph nodes near the breast and, if so, how many lymph nodes are affected.
- The letter M followed by a 0 or 1 indicates whether the cancer has spread to distant organs -- for example, the lungs or bones.

### Primary tumor (T) categories:

**TX:** Primary tumor cannot be assessed.

**T0:** No evidence of primary tumor.

**Tis:** Carcinoma in situ (DCIS, LCIS, or Paget disease of the nipple with no associated tumor mass)

**T1** (includes T1a, T1b, and T1c): Tumor is 2 cm (3/4 of an inch) or less across.

**T2:** Tumor is more than 2 cm but not more than 5 cm (2 inches) across.

**T3:** Tumor is more than 5 cm across.

**T4** (includes T4a, T4b, T4c, and T4d): Tumor of any size growing into the chest wall or skin. This includes inflammatory breast cancer.

### **Nearby lymph nodes (N; based on looking at them under a microscope):**

Lymph node staging for breast cancer has changed as technology has evolved. Earlier methods were useful in finding large deposits of cancer cells in the lymph nodes, but could miss microscopic areas of cancer spread. Newer methods have made it possible to find smaller and smaller deposits of cancer cells, but experts haven't been sure what to do with the new information. Do tiny deposits of cancer cells affect outlook the same way that larger deposits do? How much cancer in the lymph node is needed to see a change in outlook or treatment?

These questions are still being studied, but for now, a deposit of cancer cells must contain at least 200 cells or be at least 0.2 mm across (less than 1/100 of an inch) for it to change the N stage. An area of cancer spread that is smaller than 0.2 mm (or less than 200 cells) doesn't change the stage, but is recorded with abbreviations that reflect the way the cancer spread was detected. The abbreviation "i+" means that a small number of cancer cells (called *isolated tumor cells*) were seen in routine stains or when a special type of staining technique, called *immunohistochemistry*, was used.

The abbreviation "mol+" is used if the cancer could only be found using a technique called *RT-PCR*. RT-PCR is a molecular test that can find very small numbers of cells that cannot be seen even using special stains. However, this test is not often used for finding breast cancer cells in lymph nodes because the results do not influence treatment decisions.

If the area of cancer spread is at least 0.2 mm (or 200 cells), but still not larger than 2 mm, it is called a *micrometastasis* (one mm is about the size of the width of a grain of rice). Micrometastases are counted only if there aren't any larger areas of cancer spread. Areas of cancer spread larger than 2 mm are known to affect outlook and do change the N stage. These larger areas are sometimes called *macrometastases*, but are more often just called *metastases*.

**NX:** Nearby lymph nodes cannot be assessed (for example, if they were removed previously).

**N0:** Cancer has not spread to nearby lymph nodes.

- **N0(i+):** Tiny amounts of cancer are found in underarm lymph nodes by using either routine or special stains. The area of cancer spread contains less than 200 cells and is smaller than 0.2 mm.
- **N0(mol+):** Cancer cells cannot be seen in underarm lymph nodes (even using special stains), but traces of cancer cells were detected using RT-PCR.

**N1:** Cancer has spread to 1 to 3 axillary (underarm) lymph node(s), and/or tiny amounts of cancer are found in internal mammary lymph nodes (those near the breast bone) on sentinel lymph node biopsy.

- **N1mi:** Micrometastases (tiny areas of cancer spread) in 1 to 3 lymph nodes under the arm. The areas of cancer spread in the lymph nodes are 2 mm or less across (but at least 200 cancer cells or 0.2mm across).
- **N1a:** Cancer has spread to 1 to 3 lymph nodes under the arm with at least one area of cancer spread greater than 2 mm across.
- **N1b:** Cancer has spread to internal mammary lymph nodes, but this spread could only be found on sentinel lymph node biopsy (it did not cause the lymph nodes to become enlarged).
- **N1c:** Both N1a and N1b apply.

**N2:** Cancer has spread to 4 to 9 lymph nodes under the arm, or cancer has enlarged the internal mammary lymph nodes (either N2a or N2b, but not both).

- **N2a:** Cancer has spread to 4 to 9 lymph nodes under the arm, with at least one area of cancer spread larger than 2 mm.
- **N2b:** Cancer has spread to one or more internal mammary lymph nodes, causing them to become enlarged.

**N3:** Any of the following:

**N3a:** either

- Cancer has spread to 10 or more axillary lymph nodes, with at least one area of cancer spread greater than 2mm, OR
- Cancer has spread to the lymph nodes under the clavicle (collar bone), with at least one area of cancer spread greater than 2mm.

**N3b:** either:

- Cancer is found in at least one axillary lymph node (with at least one area of cancer spread greater than 2 mm) and has enlarged the internal mammary lymph nodes, OR
- Cancer has spread to 4 or more axillary lymph nodes (with at least one area of cancer spread greater than 2 mm), and tiny amounts of cancer are found in internal mammary lymph nodes on sentinel lymph node biopsy.

- **N3c:** Cancer has spread to the lymph nodes above the clavicle with at least one area of cancer spread greater than 2mm.

## Metastasis (M):

**MX:** Distant spread (metastasis) cannot be assessed.

**M0:** No distant spread is found on x-rays (or other imaging procedures) or by physical exam.

- **cM0(i +):** Small numbers of cancer cells are found in blood or bone marrow (found only by special tests), or tiny areas of cancer spread (no larger than 0.2 mm) are found in lymph nodes away from the breast.

**M1:** Cancer has spread to distant organs. (The most common sites are bone, lung, brain, and liver.)

## Breast cancer stage grouping

Once the T, N, and M categories have been determined, this information is combined in a process called *stage grouping*. Cancers with similar stages tend to have a similar outlook and are often treated in a similar way. Stage is expressed in Roman numerals from stage I (the least advanced stage) to stage IV (the most advanced stage). Non-invasive cancer is listed as stage 0.

**Stage 0: Tis, N0, M0:** This is *ductal carcinoma in situ (DCIS)*, a pre-cancer of the breast. Many consider DCIS the earliest form of breast cancer. In DCIS, cancer cells are still within a duct and have not invaded deeper into the surrounding fatty breast tissue. *Lobular carcinoma in situ (LCIS)* sometimes also is classified as stage 0 breast cancer, but most oncologists believe it is not a true cancer or pre-cancer. Paget disease of the nipple (without an underlying tumor mass) is also stage 0. In all cases the cancer has not spread to lymph nodes or distant sites.

**Stage IA: T1, N0, M0:** The tumor is 2 cm (about 3/4 of an inch) or less across (T1) and has not spread to lymph nodes (N0) or distant sites (M0).

**Stage IB: T0 or T1, N1mi, M0:** The tumor is 2 cm or less across (or is not found) (T0 or T1) with micrometastases in 1 to 3 axillary lymph nodes (the cancer in the lymph nodes is greater than 0.2mm across and/or more than 200 cells but is not larger than 2 mm)(N1mi). The cancer has not spread to distant sites (M0).

**Stage IIA:** One of the following applies:

**T0 or T1, N1 (but not N1mi), M0:** The tumor is 2 cm or less across (or is not found) (T1 or T0) and either:

- It has spread to 1 to 3 axillary lymph nodes, with the cancer in the lymph nodes larger than 2 mm across (N1a), OR

- Tiny amounts of cancer are found in internal mammary lymph nodes on sentinel lymph node biopsy (N1b), OR
- It has spread to 1 to 3 lymph nodes under the arm and to internal mammary lymph nodes (found on sentinel lymph node biopsy) (N1c).

**OR**

**T2, N0, M0:** The tumor is larger than 2 cm but less than 5 cm across (T2) but hasn't spread to the lymph nodes (N0).

The cancer hasn't spread to distant sites (M0).

**Stage IIB:** One of the following applies:

**T2, N1, M0:** The tumor is larger than 2 cm but less than 5 cm across (T2). It has spread to 1 to 3 axillary lymph nodes and/or tiny amounts of cancer are found in internal mammary lymph nodes on sentinel lymph node biopsy (N1). The cancer hasn't spread to distant sites (M0).

**OR**

**T3, N0, M0:** The tumor is larger than 5 cm across but does not grow into the chest wall or skin and has not spread to lymph nodes (T3, N0). The cancer hasn't spread to distant sites (M0).

**Stage IIIA:** One of the following applies:

**T0 to T2, N2, M0:** The tumor is not more than 5 cm across (or cannot be found) (T0 to T2). It has spread to 4 to 9 axillary lymph nodes, or it has enlarged the internal mammary lymph nodes (N2). The cancer hasn't spread to distant sites (M0).

**OR**

**T3, N1 or N2, M0:** The tumor is larger than 5 cm across but does not grow into the chest wall or skin (T3). It has spread to 1 to 9 axillary nodes, or to internal mammary nodes (N1 or N2). The cancer hasn't spread to distant sites (M0).

**Stage IIIB: T4, N0 to N2, M0:** The tumor has grown into the chest wall or skin (T4), and one of the following applies:

- It has not spread to the lymph nodes (N0).
- It has spread to 1 to 3 axillary lymph nodes and/or tiny amounts of cancer are found in internal mammary lymph nodes on sentinel lymph node biopsy (N1).
- It has spread to 4 to 9 axillary lymph nodes, or it has enlarged the internal mammary lymph nodes (N2).

The cancer hasn't spread to distant sites (M0).

Inflammatory breast cancer is classified as T4d and is at least stage IIIB. If it has spread to many nearby lymph nodes (N3) it could be stage IIIC, and if it has spread to distant lymph nodes or organs (M1) it would be stage IV.

**Stage IIIC: any T, N3, M0:** The tumor is any size (or can't be found), and one of the following applies:

- Cancer has spread to 10 or more axillary lymph nodes (N3).
- Cancer has spread to the lymph nodes under the clavicle (collar bone) (N3).
- Cancer has spread to the lymph nodes above the clavicle (N3).
- Cancer involves axillary lymph nodes and has enlarged the internal mammary lymph nodes (N3).
- Cancer has spread to 4 or more axillary lymph nodes, and tiny amounts of cancer are found in internal mammary lymph nodes on sentinel lymph node biopsy (N3).

The cancer hasn't spread to distant sites (M0).

**Stage IV: any T, any N, M1:** The cancer can be any size (any T) and may or may not have spread to nearby lymph nodes (any N). It has spread to distant organs or to lymph nodes far from the breast (M1). The most common sites of spread are the bone, liver, brain, or lung,

If you have any questions about the stage of your cancer and what it might mean in your case, be sure to ask your doctor.

## Breast cancer survival rates by stage

Survival rates are often used by doctors as a standard way of discussing a person's prognosis (outlook). Some patients with breast cancer may want to know the survival statistics for people in similar situations, while others may not find the numbers helpful, or may even not want to know them. If you decide that you do not want to read them, skip to the next section.

The 5-year observed survival rate refers to the percentage of patients who live at least 5 years after being diagnosed with cancer. Many of these patients live much longer than 5 years after diagnosis.

A relative survival rate (like the numbers below) compares the observed survival with what would be expected for people without the cancer. This helps to correct for the deaths caused by something besides cancer and is a more accurate way to describe the

effect of cancer on survival. (Relative survival rates are at least as high as observed survival, and in most cases are higher.)

In order to get 5-year survival rates, doctors have to look at people who were treated at least 5 years ago. Improvements in treatment since then may result in a more favorable outlook for people now being diagnosed with breast cancer.

Survival rates are often based on previous outcomes of large numbers of people who had the disease, but they cannot predict what will happen in any particular person's case. Many other factors may affect a person's outlook, such as your age and health, the presence of hormone receptors on the cancer cells, the treatment received, and how well the cancer responds to treatment. Your doctor can tell you how the numbers below may apply to you, as he or she is familiar with the aspects of your particular situation.

The available statistics do not divide survival rates by all of the substages, such as IA and IB. The rates for these substages are likely to be close to the rate for the overall stage. For example, the survival rate for stage IA is likely to be slightly higher than that listed for stage I, while the survival rate for stage IB would be expected to be slightly lower.

It is also important to realize that these statistics are based on the stage of the cancer when it was first diagnosed. These do not apply to cancers that later come back or spread, for example.

The rates below come from the National Cancer Institute's SEER database. They are based on the previous version of AJCC staging. In that version stage II also included patients that would now be considered stage IB.

<b>Stage</b>	<b>5-year Relative Survival Rate</b>
0	100%
I	100%
II	93%
III	72%
IV	22%

## **How is breast cancer treated?**

*This information represents the views of the doctors and nurses serving on the American Cancer Society's Cancer Information Database Editorial Board. These views are based on their interpretation of studies published in medical journals, as well as their own professional experience.*

*The treatment information in this document is not official policy of the Society and is not intended as medical advice to replace the expertise and judgment of your cancer care team. It is intended to help you and your family make informed decisions, together with your doctor.*

*Your doctor may have reasons for suggesting a treatment plan different from these general treatment options. Don't hesitate to ask him or her questions about your treatment options.*

## General types of treatment for breast cancer

The main types of treatment for breast cancer are:

- Surgery
- Radiation therapy
- Chemotherapy
- Hormone therapy
- Targeted therapy
- Bone-directed therapy

Treatments can be classified into broad groups, based on how they work and when they are used.

### **Local versus systemic therapy**

Local therapy is intended to treat a tumor at the site without affecting the rest of the body. Surgery and radiation therapy are examples of local therapies.

Systemic therapy refers to drugs which can be given by mouth or directly into the bloodstream to reach cancer cells anywhere in the body. Chemotherapy, hormone therapy, and targeted therapy are systemic therapies.

### **Adjuvant and neoadjuvant therapy**

Patients who have no detectable cancer after surgery are often given additional treatment to help keep the cancer from coming back. This is known as *adjuvant therapy*. Doctors believe that even in the early stages of breast cancer, cancer cells may break away from the primary breast tumor and begin to spread. These cells can't be felt on a physical exam or seen on x-rays or other imaging tests, and they cause no symptoms. But they can go on to become new tumors in nearby tissues, other organs, and bones. The goal of adjuvant therapy is to kill these hidden cells. Both systemic therapy (like chemotherapy, hormone therapy, and targeted therapy) and radiation can be used as adjuvant therapy.

Most, but not all, patients benefit from adjuvant therapy. How much you might benefit depends on the stage and characteristics of the cancer and what type of surgery you had. Generally speaking, if the tumor is larger or the cancer has spread to lymph nodes, it is more likely to have spread through the bloodstream, and you are more likely to see a benefit. But there are other features, some of which have been previously discussed, that may determine if a patient should get adjuvant therapy. Recommendations about adjuvant therapy are discussed in the sections on these treatments and in the section on treatment by stage.

Some patients are given treatment, such as chemotherapy or hormone therapy, **before** surgery. The goal of this treatment is to shrink the tumor in the hope it will allow a less extensive operation to be done. This is called *neoadjuvant therapy*. Neoadjuvant therapy also lowers the chance of the cancer coming back later. Many patients who get neoadjuvant therapy will not need adjuvant therapy, or will not need as much.

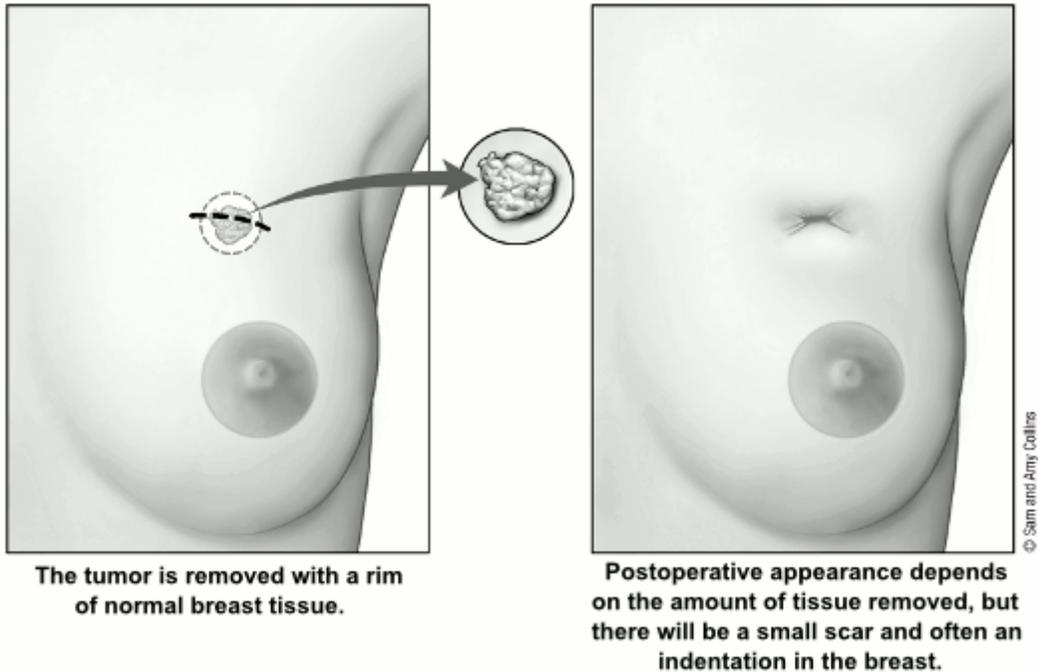
The next few sections offer general information about the types of treatments used for breast cancer. This is followed by a discussion of the typical treatment options based on the stage of the cancer (including non-invasive and invasive breast cancers), plus a small section on breast cancer treatment during pregnancy.

## Surgery for breast cancer

Most women with breast cancer have some type of surgery. Surgery is often needed to remove a breast tumor. Options for this include breast-conserving surgery and mastectomy. The breast can be reconstructed at the same time as surgery or later on. Surgery is also used to check the lymph nodes under the arm for cancer spread. Options for this include a sentinel lymph node biopsy and an axillary (armpit) lymph node dissection.

### **Breast-conserving surgery**

This type of surgery is sometimes called *partial (or segmental) mastectomy*. It is also sometimes called lumpectomy or quadrantectomy. In breast-conserving surgery, only the part of the breast containing the cancer is removed. The goal is to remove the cancer as well as some surrounding normal tissue. How much of the breast is removed depends on the size and location of the tumor and other factors.



## Lumpectomy/partial mastectomy

If cancer cells are found at any of the edges of the piece of tissue removed, it is said to have *positive margins*. When no cancer cells are found at the edges of the tissue, it is said to have *negative* or *clear margins*. The presence of positive margins means that some cancer cells may have been left behind after surgery. If the pathologist finds positive margins in the tissue removed with surgery, the surgeon may need to go back and remove more tissue. This operation is called a *re-excision*. If the surgeon can't remove enough breast tissue to get clear surgical margins, a mastectomy may be needed.

The distance from the tumor to the margin is also important. Even if the margins are “clear”, they could be “close”—meaning that the distance between the edge of the tumor and edge of the tissue removed is too small and more surgery may be needed, as well. Surgeons sometimes disagree on what is an adequate (or good) margin.

Most women need radiation therapy to the breast after breast conserving surgery. Sometimes, to make it easier to aim the radiation, small metallic clips (which will show up on x-rays) may be placed inside the breast during surgery to mark the area.

For women who need chemotherapy after surgery, the radiation is usually delayed until the chemotherapy is completed.

For most women with stage I or II breast cancer, breast-conserving surgery (BCS) plus radiation therapy is as effective as mastectomy. Survival rates of women treated with these 2 approaches are the same. But breast-conserving surgery is not an option for all

women with breast cancer (see "Choosing between breast-conserving surgery and mastectomy" below).

**Possible side effects:** Side effects of these operations can include pain, temporary swelling, tenderness, and hard scar tissue that forms in the surgical site. As with all operations, bleeding and infection at the surgery site are also possible.

The larger the portion of breast removed, the more likely it is that you will see a change in the shape of the breast afterward. If your breasts look very different after surgery, it may be possible to have some type of reconstructive surgery (see "Reconstructive surgery" below), or to have the size of the unaffected breast reduced to make the breasts more symmetrical. It may even be possible to have this done during the initial surgery. It's very important to talk with your doctor (and possibly a plastic surgeon) before surgery to get an idea of how your breasts are likely to look afterward, and to learn what your options might be.

## **Mastectomy**

Mastectomy is surgery to remove the entire breast. All of the breast tissue is removed, sometimes along with other nearby tissues.

**Simple mastectomy:** In this procedure, also called *total mastectomy*, the surgeon removes the entire breast, including the nipple, but does not remove underarm lymph nodes or muscle tissue from beneath the breast. (Sometimes lymph nodes are removed in a different procedure during the same surgery.) Sometimes both breasts are removed (a double mastectomy), often as preventive surgery in women at very high risk for getting cancer in the other breast. Most women, if they are hospitalized, can go home the next day. Simple mastectomy is the most common type of mastectomy used to treat breast cancer.

**Skin-sparing mastectomy:** For some women considering immediate reconstruction, a skin-sparing mastectomy can be done. In this procedure, most of the skin over the breast (other than the nipple and areola) is left intact. This can work as well as a simple mastectomy. The amount of breast tissue removed is the same as with a simple mastectomy.

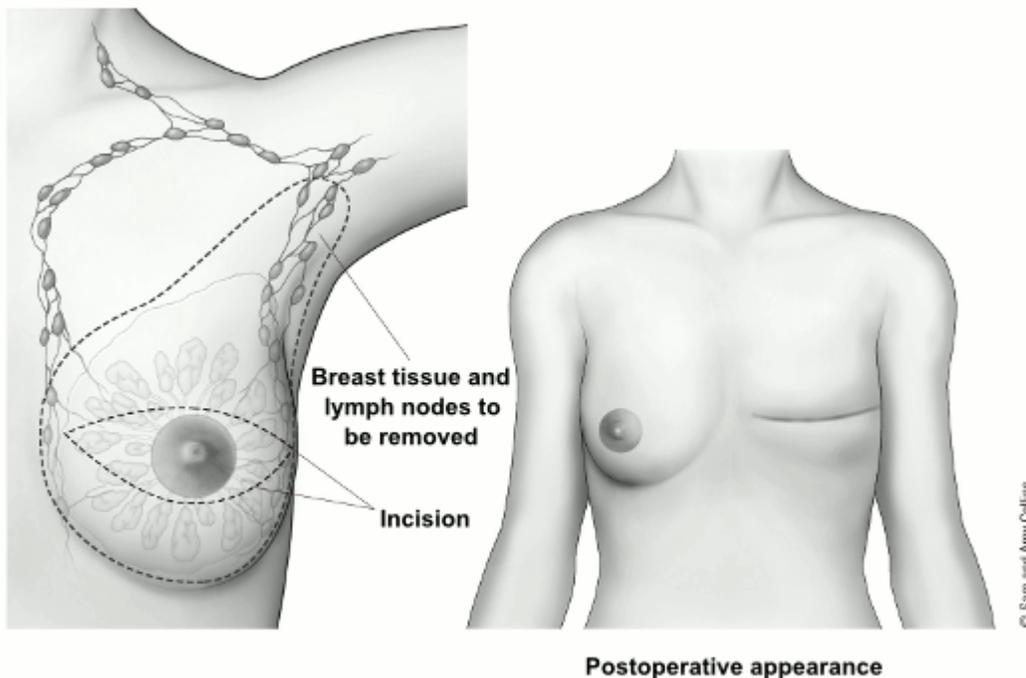
This approach is only used when immediate breast reconstruction is planned. It may not be suitable for larger tumors or those that are close to the surface of the skin. Implants or tissue from other parts of the body are used to reconstruct the breast. This approach has not been used for as long as the more standard type of mastectomy, but many women prefer it because it offers the advantage of less scar tissue and a reconstructed breast that seems more natural.

A variation of the skin-sparing mastectomy is the *nipple-sparing mastectomy*. This procedure is more often an option for women who have a small early-stage cancer near the outer part of the breast, with no signs of cancer in the skin or near the nipple. In this

procedure, the breast tissue is removed, but the breast skin and nipple are left in place. This is followed by breast reconstruction. The surgeon often removes the breast tissue beneath the nipple (and areola) during the procedure, to check for cancer cells. If cancer is found in this tissue, the nipple must be removed. Even when no cancer is found under the nipple, some doctors give the nipple tissue a dose of radiation during or after the surgery to try to reduce the risk of the cancer coming back.

There are still some problems with nipple-sparing surgeries. Afterward, the nipple does not have a good blood supply, so sometimes it can wither away or become deformed. Because the nerves are also cut, there is little or no feeling left in the nipple. In women with larger breasts, the nipple may look out of place after the breast is reconstructed. As a result, many doctors feel that this surgery is best done in women with small to medium sized breasts. This procedure leaves less visible scars, but if it isn't done properly, it can leave behind more breast tissue than other forms of mastectomy. This could result in a higher risk of cancer developing than for a skin-sparing or simple mastectomy. This was a problem in the past, but improvements in technique have helped make this surgery safer. Still, many experts consider nipple-sparing procedures too risky to be a standard treatment for breast cancer.

**Modified radical mastectomy:** This procedure is a simple mastectomy and removal of axillary (underarm) lymph nodes. Surgery to remove these lymph nodes is discussed in further detail later in this section.



## Modified radical mastectomy

**Radical mastectomy:** In this extensive operation, the surgeon removes the entire breast, axillary lymph nodes, and the pectoral (chest wall) muscles under the breast. This surgery was once very common, but less extensive surgery (such as modified radical mastectomy) has been found to be just as effective. This meant that the disfigurement and side effects of a radical mastectomy were not needed, so this surgery is rarely done now. This operation may still be done for large tumors that are growing into the pectoral muscles under the breast.

**Possible side effects:** Aside from post-surgical pain and the obvious change in the shape of the breast(s), possible side effects of mastectomy include wound infection, hematoma (buildup of blood in the wound), and seroma (buildup of clear fluid in the wound). If axillary lymph nodes are also removed, other side effects may occur (see "Lymph node surgery" below).

## **Choosing between breast-conserving surgery and mastectomy**

Many women with early-stage cancers can choose between breast-conserving surgery and mastectomy.

The main advantage of breast-conserving surgery (BCS) is that a woman keeps most of her breast. A disadvantage is that radiation therapy is usually needed after BCS—most often for 5 to 6 weeks. A small number of women having breast-conserving surgery may not need radiation while some women who have a mastectomy will still need radiation therapy to the breast area.

When deciding between BCS and mastectomy, be sure to get all the facts. You may have an initial gut preference for mastectomy as a way to "take it all out as quickly as possible." This feeling can lead women to prefer mastectomy even when their surgeons don't. But the fact is that in most cases, mastectomy does not give you any better chance of long-term survival or a better outcome from treatment. Studies following thousands of women for more than 20 years show that when BCS can be done, doing mastectomy instead does not provide any better chance of survival.

Most women and their doctors prefer BCS and radiation therapy when it's a reasonable option, but your choice will depend on a number of factors, such as:

- How you feel about losing your breast
- How you feel about getting radiation therapy
- How far you would have to travel and how much time it would take to have radiation therapy
- Whether you think you will want to have more surgery to reconstruct your breast after having a mastectomy

- Your preference for mastectomy as a way to get rid of all your cancer as quickly as possible
- Your fear of the cancer coming back

For some women, mastectomy may clearly be a better option. For example, breast conserving surgery is usually not recommended for:

- Women who have already had radiation therapy to the affected breast
- Women with 2 or more areas of cancer in the same breast that are too far apart to be removed through 1 surgical incision, while keeping the appearance of the breast satisfactory
- Women whose initial BCS along with re-excision(s) has not completely removed the cancer
- Women with certain serious connective tissue diseases such as scleroderma or lupus, which may make them especially sensitive to the side effects of radiation therapy
- Pregnant women who would require radiation while still pregnant (risking harm to the fetus)
- Women with large tumors (greater than 5 cm [2 inches] across) that didn't shrink very much with neoadjuvant chemotherapy (although this also depends on the size of the breast)
- Women with inflammatory breast cancer
- Women with a cancer that is large relative to their breast size

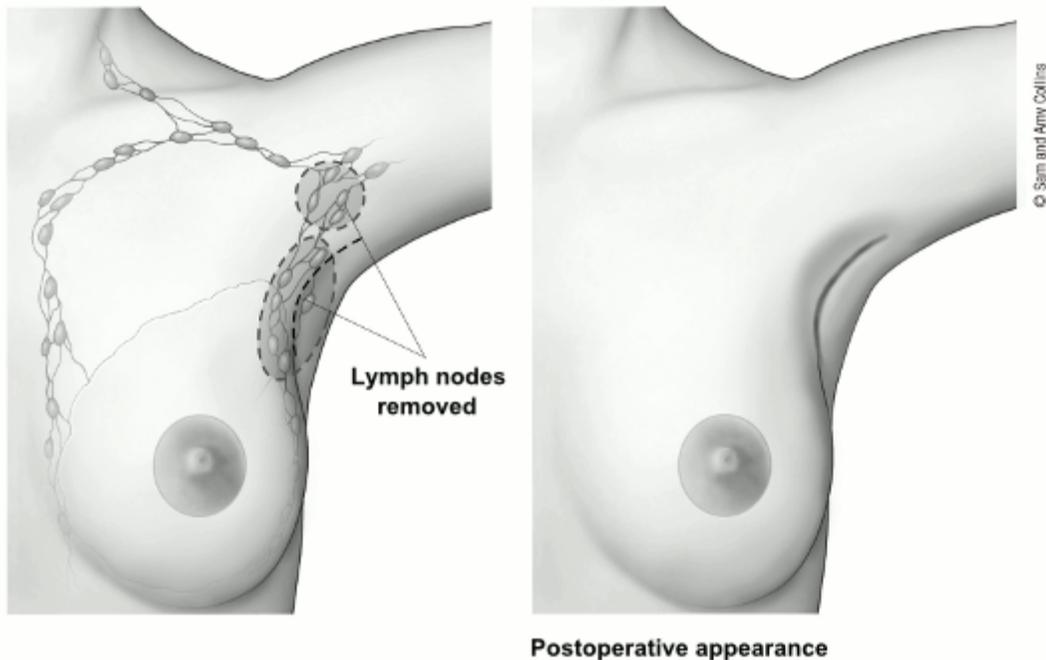
Other factors may need to be taken into account as well. For example, young women with breast cancer and a known *BRCA* mutation are at very high risk for a second cancer. These women often consider having the other breast removed to reduce this risk, and so may choose mastectomy for the breast with cancer as well. A double mastectomy may be done to treat the cancer and reduce the risk of a second breast cancer.

It is important to understand that having a mastectomy instead of breast-conserving surgery plus radiation *only* lowers your risk of developing a second breast cancer in the same breast. It does not lower the chance of the cancer coming back in other parts of the body. It is important that you don't rush into making a decision, but instead take your time deciding whether a mastectomy or breast-conserving surgery plus radiation is right for you.

## Lymph node surgery

To determine if the breast cancer has spread to axillary (underarm) lymph nodes, one or more of these lymph nodes may be removed and looked at under the microscope. This is an important part of staging. When the lymph nodes contain cancer cells, there is a higher chance that cancer cells have also spread through the bloodstream to other parts of the body. These cells could grow and cause new tumors. The presence of cancer cells in the lymph nodes under the arm is often an important factor in deciding what treatment, if any, is needed besides surgery.

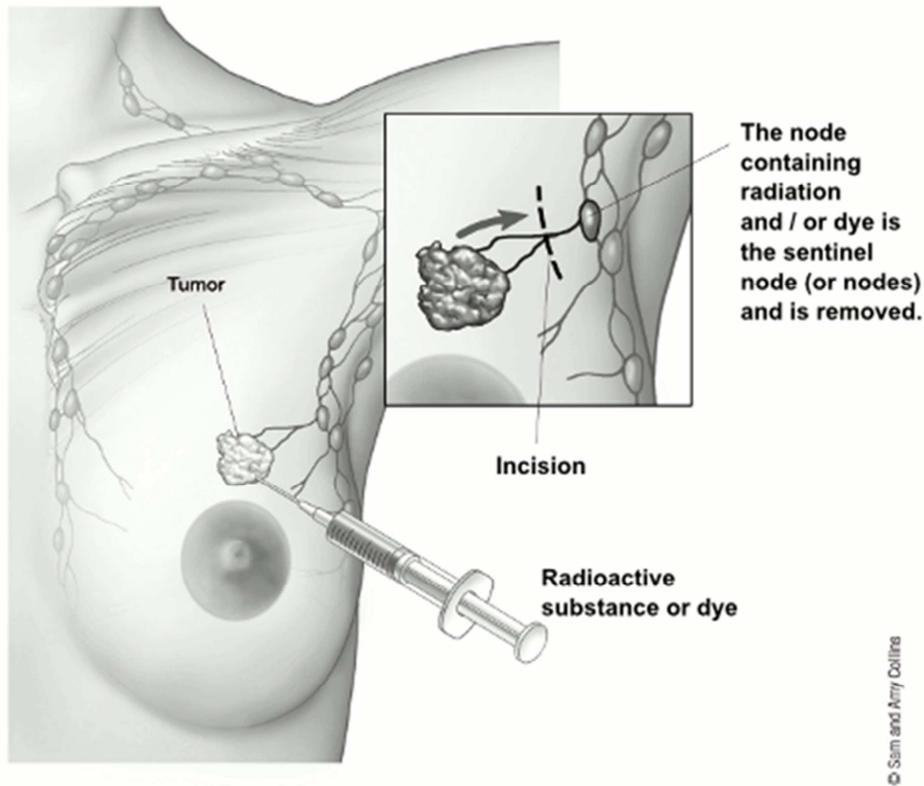
**Axillary lymph node dissection (ALND):** In this procedure, anywhere from about 10 to 40 (though usually less than 20) lymph nodes are removed from the area under the arm (axilla) and checked for cancer spread. ALND is usually done at the same time as the mastectomy or BCS, but it can be done in a second operation. This was once the most common way to check to see if breast cancer has spread to nearby lymph nodes, and it is still done in some patients. For example, an ALND may be done if a previous biopsy has shown one or more of the underarm lymph nodes have cancer cells.



### Axillary lymph node dissection

**Sentinel lymph node biopsy (SLNB):** Although axillary lymph node dissection (ALND) is a safe operation and has low rates of most side effects, removing many lymph nodes increases the risk of lymphedema (this side effect is discussed further on). To lower this risk, doctors may use a sentinel lymph node biopsy (SLNB) procedure, which can check the axillary lymph nodes for cancer without removing as many of them.

In this procedure the surgeon finds and removes the first lymph node(s) to which a tumor is likely to spread (these are called the *sentinel nodes*). To do this, the surgeon injects a radioactive substance and/or a blue dye into the tumor, the area around it, or the area around the nipple. Lymphatic vessels will carry these substances into the sentinel node(s).



## Sentinel lymph node biopsy

Then the sentinel node can be found either by using a special device to detect radioactivity in the nodes that the radioactive substance flows into, or by looking for lymph nodes that have turned blue. To double check, both methods are often used. The surgeon then cuts the skin over the area and removes the node(s) containing the dye or radiation. A pathologist then looks closely at these nodes (often 2 or 3). Because fewer nodes are removed than in an ALND, each one is looked at more closely for any cancer.

The lymph node can sometimes be checked for cancer during surgery. If cancer is found in the sentinel lymph node, the surgeon may go on to do a full axillary dissection. If no cancer cells are seen in the lymph node at the time of the surgery, or if the sentinel node is not checked at the time of the surgery, the lymph node(s) will be examined more closely over the next several days. If cancer is found in the lymph node, the surgeon may recommend a full ALND at a later time.

If there is no cancer in the sentinel node(s), it's very unlikely that the cancer has spread to other lymph nodes, so no further lymph node surgery is needed. The patient can avoid the potential side effects of a full ALND.

Until recently, if the sentinel node(s) had cancer cells, the surgeon would do a full ALND to see how many other lymph nodes were involved. But more recently, studies have shown that this may not always be needed. In some cases, it may be just as safe to leave the rest of the lymph nodes behind. This is based on certain factors, such as what type of surgery is used to remove the tumor, the size of the tumor, and what treatment is planned after surgery. Based on the studies that have looked at this, skipping the ALND may be an option for women with tumors 5 cm (2 inches) or smaller who are having breast-conserving surgery followed by radiation. Because this hasn't been studied well in women who have had mastectomy, it isn't clear that skipping the ALND would be safe for them.

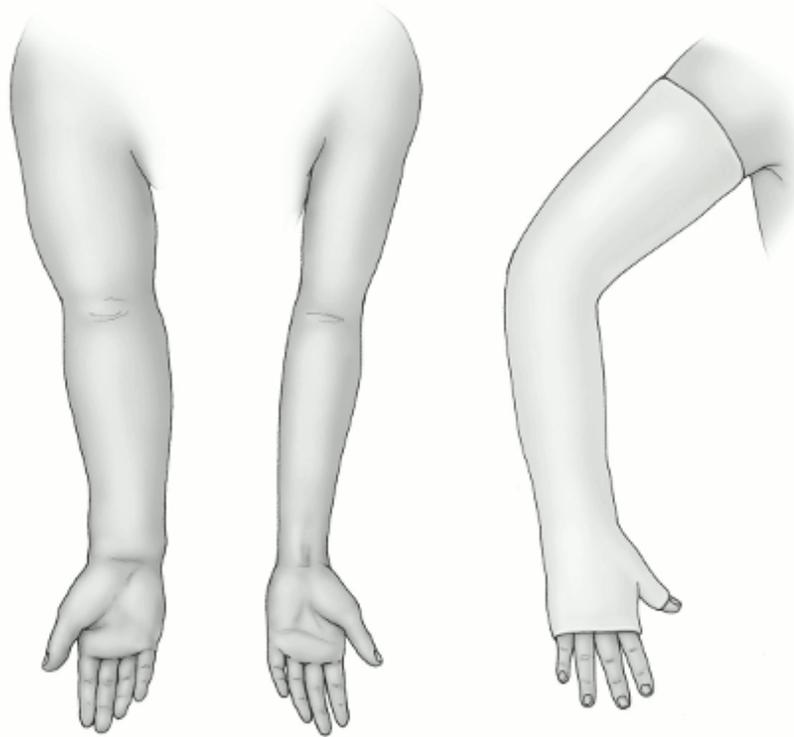
SLNB is done to see if a breast cancer has spread to nearby lymph nodes. This procedure is not done if any of the lymph nodes are known to contain cancer. If any of the lymph nodes under the arm or around the collar bone are swollen, they may be checked for cancer spread directly. Most often, a needle biopsy (either a fine needle aspiration biopsy or a core needle biopsy) is done. In these procedures, the surgeon inserts a needle into the lymph node to remove a small amount of tissue, which is then looked at under a microscope. If cancer cells are found, a full ALND is recommended.

Although SLNB has become a common procedure, it requires a great deal of skill. It should be done only by a surgeon who has experience with this technique. If you are thinking about having this type of biopsy, ask your health care team if they do them regularly.

**Possible side effects:** As with any operation, pain, swelling, bleeding, and infection are possible.

The main possible long-term effect of removing axillary lymph nodes is lymphedema (swelling) of the arm. Because any excess fluid in the arms normally travels back into the bloodstream through the lymphatic system, removing the lymph nodes sometimes blocks the drainage from the arm, causing this fluid to build up. This results in arm swelling.

Up to 30% of women who have a full ALND develop lymphedema. It also occurs in up to 3% of women who have a sentinel lymph node biopsy. It may be more common if radiation is given after surgery. Sometimes the swelling lasts for only a few weeks and then goes away. Other times, the swelling lasts a long time. See "What happens after treatment for breast cancer?" for ways to help prevent or reduce the effects of lymphedema. If your arm is swollen, tight, or painful after lymph node surgery, be sure to tell someone on your cancer care team right away. More information about lymphedema can be found in our document *Lymphedema: What Every Woman With Breast Cancer Should Know*.



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**Left, an arm showing lymphedema swelling beside an unaffected arm. Right, a compression garment used to help control lymphedema.**

You may also have limited movement in your arm and shoulder after surgery. This is more common after an ALND than a SLNB. Your doctor may give you exercises to ensure that you do not have permanent problems with movement (a frozen shoulder). Numbness of the skin on the upper, inner arm is another common side effect because the nerve that controls sensation here travels through the lymph node area.

Some women notice a rope-like structure that begins under the arm and can extend down towards the elbow. This, sometimes called *axillary web syndrome* or *lymphatic cording*, is more common after an ALND than SLNB. Symptoms may not appear for weeks or even months after surgery. It can cause pain and limit movement of the arm and shoulder. This often goes away without treatment, although some women may find physical therapy helpful.

## **Reconstructive surgery**

After having a mastectomy (or some breast-conserving surgeries), a woman might want to consider having the breast mound rebuilt; this is called *breast reconstruction*. These procedures are done to restore the breast's appearance after surgery.

If you are thinking about having reconstructive surgery, talk about it with your breast surgeon as well as a plastic surgeon experienced in breast reconstruction **before** your cancer surgery. This will allow you to consider all reconstruction options. You'll want your breast surgeon and your plastic surgeon to work together to come up with a treatment plan that will put you in the best possible position for reconstruction in case you decide to pursue it, even if you want to wait and have reconstructive surgery later.

Decisions about the type of reconstruction and when it will be done depend on each woman's medical situation and personal preferences. You may have a choice between having breast reconstruction at the same time as the mastectomy (immediate reconstruction) or at a later time (delayed reconstruction). There are several types of reconstructive surgery. Some use saline (salt water) or silicone implants, while others use tissues from other parts of your body (called an *autologous tissue reconstruction*).

To learn about different reconstruction options, see our document *Breast Reconstruction After Mastectomy*. You may also find it helpful to talk with a woman who has had the type of reconstruction you might be considering. Our Reach To Recovery volunteers can help you with this. You can find out more about our Reach To Recovery program on [cancer.org](http://cancer.org) or by calling 1-800-227-2345.

## **Some things you can expect**

The thought of surgery can be frightening. But having a better understanding of what to expect before, during, and after the operation can help.

**Before surgery:** Usually, you meet with your surgeon at least a few days before the operation to discuss the procedure and your medical history. This is a good time to ask specific questions about the surgery and go over potential risks. Be sure you understand what the extent of the surgery is likely to be and what you should expect afterward. If you are thinking about breast reconstruction, ask about this as well.

You will be asked to sign a consent form, giving the doctor permission to perform the surgery. You might also be asked to give consent for researchers to use any tissue or blood that is not needed for diagnostic purposes. This may not be of direct use to you, but it may be very helpful to women in the future.

Ask your doctor if you will possibly need a blood transfusion. If the doctors think a transfusion might be needed, you might be asked to donate blood beforehand. If you do not receive your own blood, it is important to know that in the United States, blood transfusion from another person is nearly as safe as receiving your own blood.

It is also a good idea to quit smoking before surgery. Using tobacco tightens (constricts) the blood vessels and reduces the supply of nutrients and oxygen to tissues. As with any surgery, smoking can delay healing. This can cause more noticeable scars and a longer recovery time. Women who smoke also have a higher chance of the cancer coming back later.

You will probably be told not to eat or drink anything starting the night before the surgery.

You will also meet with the anesthesiologist or nurse anesthetist who will be giving you the anesthesia during your surgery.

**During surgery:** You will have an IV (intravenous) line put in (usually in a vein in your arm), which the medical team will use to give medicines that may be needed during the surgery. Usually you will be hooked up to an electrocardiogram (EKG) machine and have a blood pressure cuff on your arm, so your heart rhythm and blood pressure can be checked during the surgery.

General anesthesia (where you are asleep) is used for most breast surgery. The length of the operation depends on the type of surgery being done. For example, a mastectomy with axillary lymph node dissection will usually take from 2 to 3 hours.

**After surgery:** After your surgery, you will be taken to the recovery room, where you will stay until you are awake and your condition and vital signs (blood pressure, pulse, and breathing) are stable. How long you stay in the hospital depends on the type of surgery being done, your overall state of health and whether you have any other medical problems, how well you do during the surgery, and how you feel after the surgery. Decisions about the length of your stay should be made by you and your doctor and not dictated by what your insurance will pay, but it is important to check your insurance coverage before surgery.

In general, women having a mastectomy and/or axillary lymph node dissection stay in the hospital for 1 or 2 nights and then go home. However, some women may be placed in a 23-hour, short-stay observation unit before going home.

Less involved operations such as breast-conserving surgery and sentinel lymph node biopsy are usually done in an outpatient surgery center, and an overnight stay in the hospital is usually not needed.

You may have a dressing (bandage) over the surgery site that may wrap snugly around your chest. You may have one or more drains (plastic or rubber tubes) coming out from the breast or underarm area to remove blood and lymph fluid that collects during the healing process. You will be taught how to care for the drains, which may include emptying and measuring the fluid and identifying problems the doctor or nurse needs to know about. Most drains stay in place for 1 or 2 weeks. When drainage has decreased to about 30 cc (1 fluid ounce) each day, the drain will usually be removed.

Most doctors will want you to start moving your arm soon after surgery so that it won't get stiff.

How long it takes to recover from breast cancer surgery depends on what procedures were done. Most women can return to their regular activities within 2 weeks after a BCS with ALND, while recovery time is often shorter for BCS plus a SLNB. It can take up to

4 weeks after a mastectomy. Recovery time is longer if reconstruction was done as well, and it can take months to return to full activity after some procedures. (For more information about recovery after breast reconstruction, see our document *Breast Reconstruction After Mastectomy*.) Still, these times can vary from person to person, so you should talk to your doctor about what you can expect.

Even after the doctor clears you to return to your regular level of activity, though, you could still feel some effects of surgery. You might feel stiff or sore for some time. The skin of your chest or underarm area may feel tight. These feelings tend to improve over time. Some women have problems with pain, numbness, or tingling in the chest and arm that continues for a long time after surgery. This, sometimes called *post-mastectomy pain syndrome*, is discussed in more detail later.

Many women who have breast-conserving surgery or mastectomy are often surprised by how little pain they have in the breast area. But they are less happy with the strange sensations (numbness, pinching/pulling feeling) they may feel in the underarm area.

Ask a member of your health care team how to care for your surgery site and arm. Usually, you and your caregivers will get written instructions about care after surgery. These instructions should include:

- The care of the surgical wound and dressing
- How to monitor drainage and take care of the drains
- How to recognize signs of infection
- Bathing and showering after surgery
- When to call the doctor or nurse
- When to begin using the arm and how to do arm exercises to prevent stiffness
- When to resume wearing a bra
- When to begin using a prosthesis and what type to use (after mastectomy)
- What to eat and not to eat
- Use of medicines, including pain medicines and possibly antibiotics
- Any restrictions of activity
- What to expect regarding sensations or numbness in the breast and arm
- What to expect regarding feelings about body image
- When to see your doctor for a follow-up appointment

- Referral to a Reach To Recovery volunteer. Through our Reach To Recovery program, a specially trained volunteer who has had breast cancer can provide information, comfort, and support (see our document *Reach To Recovery* for more information).

You will probably have a follow-up with your surgeon about 7 to 14 days after the surgery to go over the results of your pathology report and talk about any further treatment. If you will need more treatment, you will be referred to a radiation oncologist and/or a medical oncologist. If you are thinking about breast reconstruction, you may be referred to a plastic surgeon as well.

## **Chronic pain after breast surgery**

Some women have problems with nerve (neuropathic) pain in the chest wall, armpit, and/or arm after surgery that doesn't go away over time. This is called post-mastectomy pain syndrome (PMPS) because it was first described in women who had mastectomies, but it can also happen after breast-conserving therapy. Studies have shown that between 20% and 30% of women develop symptoms of PMPS after surgery. The classic symptoms of PMPS are pain and tingling in the chest wall, armpit, and/or arm. Pain may also be felt in the shoulder or surgical scar. Other common complaints include numbness, shooting or pricking pain, or unbearable itching. Most women with PMPS say their symptoms are not severe.

PMPS is thought to be linked to damage done to the nerves in the armpit and chest during surgery. But the causes are not known. Women who are younger, had a full ALND (not just SLNB), or who were treated with radiation after surgery are more likely to have problems with PMPS. Because ALNDs are done less often now, PMPS is less common than it once was.

It is important to talk to your doctor about any pain you are having. PMPS can cause you to not use your arm the way you should and over time you could lose the ability to use it normally.

PMPS can be treated. Opioids (narcotics) are medicines commonly used to treat pain, but they don't always work well for nerve pain. But there are medicines and treatments that do work for this kind of pain. Talk to your doctor to get the pain control you need.

## **Radiation therapy for breast cancer**

Radiation therapy is treatment with high-energy rays or particles that destroy cancer cells. Radiation to the breast is often given after breast-conserving surgery to help lower the chance that the cancer will come back in the breast or nearby lymph nodes. Radiation may also be recommended after mastectomy in patients either with a cancer larger than 5 cm, or when cancer is found in the lymph nodes.

Radiation is also used to treat cancer that has spread to other areas, for example to the bones or brain.

Radiation therapy can be given externally (external beam radiation) or internally (brachytherapy).

## **External beam radiation**

This is the most common type of radiation therapy for women with breast cancer. The radiation is focused from a machine outside the body on the area affected by the cancer.

The extent of radiation depends on whether mastectomy or breast-conserving surgery (BCS) was done and whether or not lymph nodes are involved.

If mastectomy was done and no lymph nodes had cancer, radiation is targeted at the chest wall and the places where any drains exited the body.

If BCS was done, most often the entire breast gets radiation, and an extra boost of radiation is given to the area in the breast where the cancer was removed to prevent it from coming back in that area. The boost is often given after the treatments to the whole breast have ended. It uses the same machine, but the beams are aimed at the place where the cancer was removed. Most women don't notice different side effects from boost radiation than from whole breast radiation.

If cancer was found in the lymph nodes under the arm, radiation may be given to this area as well. In some cases, the area treated may also include supraclavicular lymph nodes (nodes above the collarbone) and internal mammary lymph nodes (nodes beneath the breast bone in the center of the chest).

When given after surgery, external radiation therapy is usually not started until the tissues have been able to heal, often a month or longer. If chemotherapy is to be given as well, radiation therapy is usually delayed until chemotherapy is complete.

Before your treatments start, the radiation team will take careful measurements to determine the correct angles for aiming the radiation beams and the proper dose of radiation. They will make some ink marks or small tattoos on your skin that they will use later as a guide to focus the radiation on the right area. You might want to ask your health care team if these marks will be permanent.

Lotions, powders, deodorants, and antiperspirants can interfere with external beam radiation therapy, so your health care team may tell you not to use them until treatments are complete.

External radiation therapy is much like getting an x-ray, but the radiation is more intense. The procedure itself is painless. Each treatment lasts only a few minutes, but the setup time—getting you into place for treatment—usually takes longer.

Breast radiation is most commonly given 5 days a week (Monday through Friday) for about 5 to 6 weeks.

Some older women who have breast conserving surgery for early stage breast cancer don't need radiation. (See "Treatment of invasive breast cancer, by stage.")

**Accelerated breast irradiation:** The standard approach of getting external radiation for 5 days a week over many weeks can be inconvenient for many women. Some doctors are now using other schedules, such as giving slightly larger daily doses over only 3 weeks.

Giving radiation in larger doses using fewer treatments is known as *hypofractionated radiation therapy*. This approach was studied in a large group of women who had been treated with breast conserving surgery (BCS) and who did not have cancer spread to underarm lymph nodes.

When compared with giving the radiation over 5 weeks, giving it over only 3 weeks was just as good at keeping the cancer from coming back in the same breast over the first 10 years after treatment. Newer approaches now being studied give radiation over an even shorter period of time. In one approach, larger doses of radiation are given each day, but the course of radiation is shortened to only 5 days. *Intraoperative radiation therapy* (IORT) is another approach that gives a single large dose of radiation in the operating room right after BCS (before the breast incision is closed). IORT requires special equipment and is not widely available.

**3D-conformal radiotherapy:** In this technique, the radiation is given with special machines so that it is better aimed at the area where the tumor was. This allows more of the healthy breast to be spared. Treatments are given twice a day for 5 days. Because only part of the breast is treated, this is considered to be a form of *accelerated partial breast irradiation*.

Other forms of accelerated partial breast irradiation are described below, under "Brachytherapy." It is hoped that these approaches may prove to be at least equal to the current, standard breast irradiation, but few studies have compared these new methods directly to standard radiation therapy. It is not known if all of the newer methods will still be as good as standard radiation after many years, so many doctors still consider them experimental. Women who are interested in these approaches may want to ask their doctor about taking part in clinical trials of accelerated breast irradiation now going on.

**Possible side effects of external radiation:** The main short-term side effects of external beam radiation therapy to the breast are swelling and heaviness in the breast, skin changes in the treated area, and fatigue. Skin changes can range from mild redness to blistering and peeling. Your health care team may advise you to avoid exposing the treated skin to the sun because it may make the skin changes worse. Most skin changes get better within a few months. Changes to the breast tissue usually go away in 6 to 12 months, but it can take up to 2 years.

In some women, the breast becomes smaller and firmer after radiation therapy. Having radiation may also affect your options for breast reconstruction later on. It can also raise the risk of problems if it is given after reconstruction, especially tissue flap procedures. Women who have had breast radiation may have problems breastfeeding later on. Radiation to the breast can also sometimes damage some of the nerves to the arm. This is called *brachial plexopathy* and can lead to numbness, pain, and weakness in the shoulder, arm and hand.

Radiation therapy of axillary lymph nodes also can cause lymphedema. (See the section "What happens after treatment for breast cancer?")

In rare cases, radiation therapy may weaken the ribs, which could lead to a fracture. In the past, parts of the lungs and heart were more likely to get some radiation, which could lead to long-term damage of these organs in some women. But modern radiation therapy equipment allows doctors to better focus the radiation beams, so these problems are rare today.

A very rare complication of radiation to the breast is the development of another cancer called *angiosarcoma*. (See the section "What is breast cancer?") These rare cancers can grow and spread quickly.

## **Brachytherapy**

Brachytherapy, also known as *internal radiation*, is another way to deliver radiation therapy. Instead of aiming radiation beams from outside the body, radioactive seeds or pellets are placed into a device in the breast tissue in the area where the cancer had been. It can be used along with external beam radiation in patients who had breast conserving surgery (BCS) as a way to add an extra boost of radiation to the tumor site. It may also be used by itself (instead of radiation to the whole breast). Tumor size, location, and other factors may limit who can get brachytherapy.

There are different types of brachytherapy.

**Interstitial brachytherapy:** In this approach, several small, hollow tubes called *catheters* are inserted into the breast around the area where the cancer was removed and are left in place for several days. Radioactive pellets are inserted into the catheters for short periods of time each day and then removed. This method of brachytherapy has been around longer (and has more evidence to support it), but it is not used as much anymore.

**Intracavitary brachytherapy:** This is the most common type of brachytherapy for women with breast cancer and is considered a form of accelerated partial breast irradiation. A device is put into the space left from BCS and is left in place until treatment is complete. There are several different devices that can be used: MammoSite<sup>®</sup>, SAVI<sup>®</sup>, Axxent<sup>®</sup>, and Contura<sup>®</sup>. They all go into the breast as a small catheter (tube). The end of the device inside the breast is then expanded so that it stays securely in the right place for the entire treatment. The other end of the catheter sticks out of the breast.

For each treatment, one or more sources of radiation (often pellets) is placed down through the tube and into the device for a short time and then removed. Treatments are given twice a day for 5 days as an outpatient. After the last treatment, the device is collapsed down again and removed.

Early studies of intracavitary brachytherapy as the only radiation after breast conserving surgery (BCS) had promising results, but didn't directly compare this technique with standard whole breast external beam radiation.

One study that compared outcomes between intracavitary brachytherapy and whole breast radiation after BCS found that women treated with brachytherapy were twice as likely to go on to get a mastectomy of the treated breast (most likely because cancer was found again in that breast). The overall risk was still low, however, with about 4% of the women in the brachytherapy group needing mastectomy versus only 2% of the women in the whole breast radiation group.

This study raises questions about whether irradiating only the area around the cancer will reduce the chances of the cancer coming back as much as giving radiation to the whole breast. More studies comparing the 2 approaches are needed to see if brachytherapy should be used instead of whole breast radiation.

Intracavitary brachytherapy can also have side effects, including redness, bruising, breast pain, infection, and a break-down of an area of fat tissue in the breast. As with whole breast radiation, weakness and fracture of the ribs can also occur.

For more information about radiation therapy, see the "Radiation Therapy" section of our website or our document *Understanding Radiation Therapy: A Guide for Patients and Families*.

## Chemotherapy for breast cancer

Chemotherapy (*chemo*) is treatment with cancer-killing drugs that may be given intravenously (injected into a vein) or by mouth. The drugs travel through the bloodstream to reach cancer cells in most parts of the body. Chemo is given in cycles, with each period of treatment followed by a recovery period. Treatment usually lasts for several months.

If you'd like more information on a drug used in your treatment or a specific drug mentioned in this section, see our Guide to Cancer Drugs, or call us with the names of the medicines you're taking.

### **When is chemotherapy used?**

There are several situations in which chemo may be recommended.

**After surgery (adjuvant chemotherapy):** When therapy is given to patients with no evidence of cancer after surgery, it is called *adjuvant therapy*. Surgery is used to remove all of the cancer that can be seen, but adjuvant therapy is used to kill any cancer cells that may have been left behind or spread but can't be seen, even on imaging tests. If these cells are allowed to grow, they can establish new tumors in other places in the body. Adjuvant therapy after breast-conserving surgery or mastectomy reduces the risk of breast cancer coming back. Radiation, chemo, targeted therapy, and hormone therapy can all be used as adjuvant treatments.

**Before surgery (neoadjuvant chemotherapy):** *Neoadjuvant therapy* is like adjuvant therapy, except you get the treatments (or at least start them) before surgery instead of after. In terms of survival and the cancer coming back, there is no difference between getting chemo before or after surgery. But neoadjuvant chemo does have two benefits. First, chemo may shrink the tumor so that it can be removed with less extensive surgery. That is why neoadjuvant chemo is often used to treat cancers that are too big to be surgically removed at the time of diagnosis (called *locally advanced*). Also, by giving chemo before the tumor is removed, doctors can better see how the cancer responds. If the first set of drugs do not shrink the tumor, your doctor will know that other drugs are needed.

**For advanced breast cancer:** Chemo can also be used as the main treatment for women whose cancer has spread outside the breast and underarm area, either when it is diagnosed or after initial treatments. The length of treatment depends on whether the cancer shrinks, how much it shrinks, and how well you tolerate treatment.

## How is chemotherapy given?

In most cases (especially adjuvant and neoadjuvant treatment), chemo is most effective when combinations of more than one drug are used. Many combinations are being used, and it's not clear that any single combination is clearly the best. Clinical studies continue to compare today's most effective treatments against something that may be better.

The most common chemo drugs used for early breast cancer include the anthracyclines (such as doxorubicin/Adriamycin<sup>®</sup> and epirubicin/Ellence<sup>®</sup>) and the taxanes (such as paclitaxel/Taxol<sup>®</sup> and docetaxel/Taxotere<sup>®</sup>). These may be used in combination with certain other drugs, like fluorouracil (5-FU), cyclophosphamide (Cytosan<sup>®</sup>), and carboplatin.

For cancers that are HER2 positive, the targeted drug trastuzumab (Herceptin<sup>®</sup>) is often given with one of the taxanes. Pertuzumab (Perjeta<sup>®</sup>) can also be combined with trastuzumab and docetaxel for HER2 positive cancers. (See “Targeted therapy for breast cancer” for more information about these drugs.)

Many chemo drugs are useful in treating women with advanced breast cancer, such as:

- Docetaxel

- Paclitaxel
- Platinum agents (cisplatin, carboplatin)
- Vinorelbine (Navelbine<sup>®</sup>)
- Capecitabine (Xeloda<sup>®</sup>)
- Liposomal doxorubicin (Doxil<sup>®</sup>)
- Gemcitabine (Gemzar<sup>®</sup>)
- Mitoxantrone
- Ixabepilone (Ixempra<sup>®</sup>)
- Albumin-bound paclitaxel (nab-paclitaxel or Abraxane<sup>®</sup>)
- Eribulin (Halaven<sup>®</sup>)

Although drug combinations are often used to treat early breast cancer, advanced disease is more often treated with single chemo drugs. Still some combinations, such as carboplatin or cisplatin plus gemcitabine are commonly used to treat advanced breast cancer.

One or more drugs that target HER2 may be used with chemo for tumors that are HER2-positive (these drugs are discussed in more detail in the "Targeted therapy for breast cancer" section).

Doctors give chemo in cycles, with each period of treatment followed by a rest period to give the body time to recover from the effects of the drugs. Chemo begins on the first day of each cycle, but the schedule varies depending on the drugs used. For example, with some drugs, the chemo is given only on the first day of the cycle. With others, it is given every day for 14 days, or weekly for 2 weeks. Then, at the end of the cycle, the chemo schedule repeats to start the next cycle. Cycles are most often 2 or 3 weeks long, but they vary according to the specific drug or combination of drugs. Some drugs are given more often. Adjuvant and neoadjuvant chemo is often given for a total of 3 to 6 months, depending on the drugs that are used. Treatment may be longer for advanced breast cancer and is based on how well it is working and what side effects you have.

**Dose-dense chemotherapy:** Doctors have found that giving the cycles of certain chemo agents closer together can lower the chance that the cancer will come back and improve survival in some women. This usually means giving the same chemo that may be given every 3 weeks (such as AC → T), but giving it every 2 weeks. A drug (growth factor) to help boost the white blood cell count is given after chemo to make sure the white blood cell count returns to normal in time for the next cycle. This approach can be used for neoadjuvant and adjuvant treatment. It can lead to more problems with low blood cell counts, so it isn't for everyone.

## Possible side effects

Chemo drugs work by attacking cells that are dividing quickly, which is why they work against cancer cells. But other cells in the body, like those in the bone marrow, the lining of the mouth and intestines, and the hair follicles, also divide quickly. These cells are also likely to be affected by chemo, which can lead to side effects. Some women have many side effects; others may only have few.

Chemo side effects depend on the type of drugs, the amount taken, and the length of treatment. Some of the most common possible side effects include:

- Hair loss and nail changes
- Mouth sores
- Loss of appetite or increased appetite
- Nausea and vomiting
- Low blood cell counts

Chemo can affect the blood forming cells of the bone marrow, which can lead to:

- Increased chance of infections (from low white blood cell counts)
- Easy bruising or bleeding (from low blood platelet counts)
- Fatigue (from low red blood cell counts and other reasons)

These side effects usually last a short time and go away after treatment is finished. It's important to tell your health care team if you have any side effects, as there are often ways to lessen them. For example, drugs can be given to help prevent or reduce nausea and vomiting.

Other side effects are also possible. Some of these are more common with certain chemo drugs. Your cancer care team will tell you about the possible side effects of the specific drugs you are getting.

**Menstrual changes:** For younger women, changes in menstrual periods are a common side effect of chemo. Premature menopause (not having any more menstrual periods) and infertility (not being able to become pregnant) may occur and may be permanent. Some chemo drugs are more likely to cause this than others. The older a woman is when she receives chemotherapy, the more likely it is that she will become infertile or go through menopause as a result. When this happens, there is an increased risk of bone loss and osteoporosis. There are medicines that can treat or help prevent problems with bone loss.

Even if your periods have stopped while you were on chemo, you may still be able to get pregnant. Getting pregnant while receiving chemo could lead to birth defects and

interfere with treatment. If you are pre-menopausal before treatment and are sexually active, it is important to discuss using birth control with your doctor. For women with hormone receptor-positive breast cancer, some types of hormonal birth control (like birth control pills) are not good idea, so it is important to talk with both your oncologist and your gynecologist (or family doctor) about what options would be best in your case. Women who have finished treatment (like chemo) can safely go on to have children, but it's not safe to get pregnant while on treatment.

If you are pregnant when you get breast cancer, you still can be treated. Certain chemo drugs can be given safely during the last 2 trimesters of pregnancy. (See “Treatment of breast cancer during pregnancy.”)

If you think you might want to have children after being treated for breast cancer, talk with your doctor before you start treatment. See our document *Fertility and Women With Cancer* for more information.

**Neuropathy:** Many drugs used to treat breast cancer, including the taxanes (docetaxel and paclitaxel), platinum agents (carboplatin, cisplatin), vinorelbine, erubulin, and ixabepilone, can damage nerves outside of the brain and spinal cord. This can sometimes lead to symptoms (mainly in the hands and feet) like numbness, pain, burning or tingling sensations, sensitivity to cold or heat, or weakness. In most cases this goes away once treatment is stopped, but it might last a long time in some women. See our document *Peripheral Neuropathy Caused By Chemotherapy* for more information.

**Heart damage:** Doxorubicin, epirubicin, and some other drugs may cause permanent heart damage (called *cardiomyopathy*). The risk of this occurring depends on how much of the drug is given, and is highest if the drug is used for a long time or in high doses. Doctors watch closely for this side effect. Most doctors will check your heart function with a test like a MUGA or an echocardiogram before starting one of these drugs. They also carefully control the doses, watch for symptoms of heart problems, and may repeat the heart test to monitor function. If the heart function begins to decline, treatment with these drugs will be stopped. Still, in some people, heart damage takes a long time to develop. Signs might not appear until months or years after treatment stops. Heart damage from these drugs happens more often if other drugs that can cause heart damage, such as trastuzumab and other drugs that target HER2 are used as well, so doctors are more cautious when these drugs are used together.

**Hand-foot syndrome:** Certain chemo drugs, such as capecitabine and liposomal doxorubicin, can irritate the palms of the hands and the soles of the feet. This is called *hand-foot syndrome*. Early symptoms include numbness, tingling, and redness. If it gets worse, the hands and feet can become swollen and uncomfortable or even painful. The skin may blister, leading to peeling of the skin or even open sores. There is no specific treatment, although some creams may help. These symptoms gradually get better when the drug is stopped or the dose is decreased. The best way to prevent severe hand-foot syndrome is to tell your doctor when early symptoms come up, so that the drug dose can

be changed. This syndrome can also occur when the drug 5-FU is given as an IV infusion over several days (this is not commonly used to treat breast cancer).

**Chemo brain:** Another possible side effect of chemo is "chemo brain." Many women who are treated for breast cancer report a slight decrease in mental functioning. They may have some problems with concentration and memory, which may last a long time. Although many women have linked this to chemo, it also has been seen in women who did not get chemo as a part of their treatment. Still, most women function well after treatment. In studies that have found chemo brain to be a side effect of treatment, the symptoms most often go away in a few years. For more information, see our document *Chemo Brain*.

**Increased risk of leukemia:** Very rarely, certain chemo drugs can permanently damage the bone marrow, leading to a disease called *myelodysplastic syndrome* or even acute myeloid leukemia, a life-threatening cancer of white blood cells. When this happens it is usually within 10 years after treatment. In most women, the benefits of chemo in preventing breast cancer from coming back or in extending life are likely to far exceed the risk of this rare but serious complication.

**Feeling unwell or tired:** Many women do not feel as healthy after receiving chemo as they did before. There is often a residual feeling of body pain or achiness and a mild loss of physical functioning. These may be very subtle changes that are only revealed by closely questioning women who have undergone chemo.

Fatigue is another common (but often overlooked) problem for women who have received chemo. This may last up to several years. It can often be helped, so it is important to let your doctor or nurse know about it. For more information on what you can do about fatigue, see our document *Fatigue in People with Cancer*. Exercise, naps, and conserving energy may be recommended. If you have sleep problems, they can be treated. Sometimes there is depression, which may be helped by counseling and/or medicines.

For more information about chemotherapy, see the "Chemotherapy" section of our website, or our document *A Guide to Chemotherapy*.

## Hormone therapy for breast cancer

Hormone therapy is another form of systemic therapy. It is most often used as an adjuvant therapy to help reduce the risk of the cancer coming back after surgery, but it can be used as neoadjuvant treatment, as well. It is also used to treat cancer that has come back after treatment or has spread.

A woman's ovaries are the main source of the hormone *estrogen* until menopause. After menopause, smaller amounts are still made in the body's fat tissue, where a hormone made by the adrenal gland is converted into estrogen.

Estrogen promotes the growth of cancers that are hormone receptor-positive. About 2 out of 3 of breast cancers are hormone receptor-positive — they contain receptors for the hormones estrogen (ER-positive cancers) and/or progesterone (PR-positive cancers). Most types of hormone therapy for breast cancer either lower estrogen levels or stop estrogen from acting on breast cancer cells. This kind of treatment is helpful for hormone receptor-positive breast cancers, but it does not help patients whose tumors are hormone receptor negative (both ER- and PR-negative).

If you'd like more information on a drug used in your treatment or a specific drug mentioned in this section, see our [Guide to Cancer Drugs](#), or call us with the names of the medicines you're taking.

## Drugs that block estrogen

**Tamoxifen:** Tamoxifen blocks estrogen receptors in breast cancer cells. This stops estrogen from binding to them and telling the cells to grow and divide. While tamoxifen acts like an anti-estrogen in breast cells, it acts like an estrogen in other tissues, like the uterus and the bones. Because it acts like estrogen in some tissues but like an anti-estrogen in others, it is called a *selective estrogen receptor modulator* or SERM.

For women with hormone receptor-positive invasive breast cancer, tamoxifen can be given for 5 to 10 years after surgery to lower the chances of the cancer coming back and helping patients live longer. It also lowers the risk of a new breast cancer in the other breast. For early stage breast cancer, this drug is mainly used for women who have not yet gone through menopause. Aromatase inhibitors (discussed below) are the preferred treatment for women who have gone through menopause.

For women who have been treated for ductal carcinoma in situ (DCIS) that is hormone receptor-positive, taking tamoxifen for 5 years lowers the chance of the DCIS coming back. It also lowers the chance of getting an invasive breast cancer.

Tamoxifen can also stop the growth and even shrink tumors in women with metastatic breast cancer. It can also be used to reduce the risk of developing breast cancer in women at high risk.

This drug is taken by mouth, most often as a pill.

The most common side effects of these drugs include fatigue, hot flashes, vaginal dryness or discharge, and mood swings.

Some women with bone metastases may have a "tumor flare" with pain and swelling in the muscles and bones. This usually subsides quickly, but in some rare cases a woman may also develop a high calcium level in the blood that cannot be controlled. If this occurs, the treatment may need to be stopped for a time.

Rare, but more serious side effects are also possible. These drugs can increase the risk of developing cancers of the uterus (endometrial cancer and uterine sarcoma) in women who

have gone through menopause. Tell your doctor right away about any unusual vaginal bleeding (a common symptom of both of these cancers). Most uterine bleeding is not from cancer, but this symptom always needs prompt attention.

Blood clots are another possible serious side effect. They usually form in the legs (called *deep venous thrombosis* or DVT), but sometimes a piece of clot may break off and end up blocking an artery in the lungs (*pulmonary embolism* or PE). Call your doctor or nurse right away if you develop pain, redness, or swelling in your lower leg (calf), shortness of breath, or chest pain because these can be symptoms of a DVT or PE.

Rarely, tamoxifen has been associated with strokes in post-menopausal women so tell your doctor if you have severe headaches, confusion, or trouble speaking or moving.

These drugs might also increase the risk of a heart attack.

Depending on a woman's menopausal status, tamoxifen can have different effects on the bones. In pre-menopausal women, tamoxifen can cause some bone thinning, but in post-menopausal women it is often good for bone strength.

The benefits of taking these drugs outweigh the risks for almost all women with hormone receptor-positive invasive breast cancer.

**Toremifene (Fareston<sup>®</sup>):** Toremifene is a drug similar to tamoxifen. It is also a SERM and has similar side effects. It is only approved to treat metastatic breast cancer. This drug is not likely to work if tamoxifen has been used and stopped working.

**Fulvestrant (Faslodex<sup>®</sup>):** Fulvestrant is a drug that first blocks the estrogen receptor and then also eliminates it temporarily. It is not a SERM – it acts like an anti-estrogen throughout the body.

Fulvestrant is used to treat advanced (metastatic breast cancer), most often after other hormone drugs (like tamoxifen and often an aromatase inhibitor) have stopped working.

It is given by injections into the buttocks. For the first month, the shots are given 2 weeks apart. After that, it is given once a month. Common short-term side effects can include hot flashes, night sweats, mild nausea, and fatigue. Because it blocks estrogen, in theory it could weaken bones (osteoporosis) if it is taken for a long time.

It is currently only approved by the FDA for use in post-menopausal women with advanced breast cancer that no longer responds to tamoxifen or toremifene. It is sometimes used “off-label” in pre-menopausal women, often combined with a luteinizing-hormone releasing hormone (LHRH) agonist to turn off the ovaries (see below).

## Treatments to lower estrogen levels

**Aromatase inhibitors (AIs):** Three drugs that stop estrogen production in post-menopausal women have been approved to treat both early and advanced breast cancer: letrozole (Femara), anastrozole (Arimidex), and exemestane (Aromasin). They work by blocking an enzyme (aromatase) in fat tissue that is responsible for making small amounts of estrogen in post-menopausal women. They cannot stop the ovaries from making estrogen, so they are only effective in women whose ovaries aren't working, either due to menopause or due to treatment with luteinizing hormone-releasing hormone analogs (these are discussed later on). AIs are taken daily as pills. So far, drugs in this group seem to work equally well in treating breast cancer.

Several studies have compared these drugs to tamoxifen as adjuvant (after surgery) hormone therapy in post-menopausal women. Using these drugs, either alone or after tamoxifen, has been shown to better reduce the risk of the cancer coming back later than using just tamoxifen for 5 years. Schedules that are known to be helpful include:

- Tamoxifen for 2 to 3 years, followed by an aromatase inhibitor (AI) to complete 5 years of treatment
- Tamoxifen for 5 years, followed by an AI for 5 years
- An AI for 5 years

Most doctors now recommend post-menopausal women whose cancers are hormone receptor-positive use an AI at some point during adjuvant therapy. Right now, standard treatment is to use these drugs for about 5 years (or alternate with tamoxifen for a total of at least 5 years). Studies now being done to see if giving an AI for more than 5 years would be more helpful.

For women with early-stage breast cancer who have not gone through menopause when they are first diagnosed, tamoxifen is often used first, and then an AI may be given later if they go through menopause during treatment. Another option is taking a drug that turns off the ovaries (a luteinizing hormone-releasing hormone analog) along with an AI.

The AIs tend to have fewer serious side effects than tamoxifen—they don't cause uterine cancers and very rarely cause blood clots. They can, however, cause muscle pain and joint stiffness and/or pain. The joint pain may be similar to a new feeling of having arthritis in many different joints at one time. This side effect may improve by switching to a different AI, but it has led some women to stop drug treatment. If this happens, most doctors recommend using tamoxifen to complete 5 years of hormone treatment.

Because aromatase inhibitors remove all estrogens from women after menopause, they also cause bone thinning, sometimes leading to osteoporosis and even fractures. Many women treated with an aromatase inhibitor are also treated with medicine to strengthen

their bones, such as bisphosphonates or denosumab (these drugs are discussed in the section “Bone-directed therapy for breast cancer”).

**Ovarian ablation:** In pre-menopausal women, removing or shutting down the ovaries (ovarian ablation), the main source of estrogens, effectively makes the woman post-menopausal. This may allow some other hormone therapies to work better and is most often used to treat metastatic breast cancer, but has also been studied in patients with early-stage disease.

Permanent ovarian ablation can be done by surgically removing the ovaries. This operation is called an *oophorectomy*. More often, ovarian ablation is done with drugs called *luteinizing hormone-releasing hormone* (LHRH) analogs, such as goserelin (Zoladex<sup>®</sup>) or leuprolide (Lupron<sup>®</sup>). These drugs stop the signal that the body sends to ovaries to make estrogens. They can be used alone or with other hormone drugs (tamoxifen, aromatase inhibitors, fulvestrant) as hormone therapy in pre-menopausal women.

Chemotherapy drugs may also damage the ovaries of pre-menopausal women so they no longer produce estrogen. In some women, ovarian function returns months or years later, but in others, the damage to the ovaries is permanent and leads to menopause. This can sometimes be a helpful (if unintended) consequence of chemotherapy with regard to breast cancer treatment, although it leaves the woman infertile.

All of these methods can cause a woman to have symptoms of menopause, including hot flashes, night sweats, vaginal dryness, and mood swings.

### **Less commonly used types of hormone therapy**

These options were used more often in the past, but are rarely given now. Megestrol acetate (Megace<sup>®</sup>) is a progesterone-like drug used that can be used as a hormone treatment of advanced breast cancer, usually for women whose cancers do not respond to the other hormone treatments. Its major side effect is weight gain, and it is sometimes used in higher doses to reverse weight loss for people with advanced cancer.

Androgens (male hormones) may rarely be considered after other hormone treatments for advanced breast cancer have been tried. They are sometimes effective, but they can cause masculine characteristics to develop such as an increase in body hair and a deeper voice.

Another option that may rarely be tried when the cancer is no longer responding to other hormone drugs is giving high doses of estrogen. The main risk is of serious blood clots (like DVTs and PEs). This treatment can also cause nausea.

### **Targeted therapy for breast cancer**

As researchers have learned more about the gene changes in cells that cause cancer, they have been able to develop newer drugs that specifically target these changes. These

targeted drugs work differently from standard chemotherapy (chemo) drugs. They often have different (and less severe) side effects.

If you'd like more information on a drug used in your treatment or a specific drug mentioned in this section, see our Guide to Cancer Drugs, or call us with the names of the medicines you're taking.

## **Drugs that target the HER2/neu protein**

In about 1 in 5 patients with breast cancer, the cancer cells have too much of a growth-promoting protein known as HER2/neu (or just HER2) on their surface. Breast cancers with too much of this protein tend to grow and spread more aggressively without special treatment. A number of drugs have been developed that target this protein:

- Trastuzumab (Herceptin)
- Pertuzumab (Perjeta<sup>®</sup>)
- Ado-trastuzumab emtansine (Kadcyla<sup>™</sup>)
- Lapatinib (Tykerb)

Trastuzumab and pertuzumab are monoclonal antibodies — man-made versions of a very specific immune system protein. They are given into a vein (IV).

Ado-trastuzumab emtansine is a monoclonal antibody attached to a chemotherapy drug. It is also given IV.

Lapatinib is a targeted drug that is not an antibody. It is given as a pill.

### **When are these drugs used**

Trastuzumab can be used to treat both early- and late-stage breast cancer. When used to treat early breast cancer, this drug is usually given for a year. For advanced breast cancer, treatment doesn't stop after a year and can last a long time.

Pertuzumab can be given with trastuzumab and chemotherapy to treat advanced breast cancer. This combination is also used to treat early breast cancer before surgery.

Ado-trastuzumab emtansine is used to treat advanced breast cancer in women who have already been treated with trastuzumab.

Lapatinib is used to treat advanced breast cancer. It is most often used if the doctor thinks that trastuzumab is no longer working.

### **Side effects**

The side effects of these drugs are often mild. Discuss what you can expect with your doctor.

Some women do develop heart damage during or after treatment with the antibody drugs (trastuzumab, pertuzumab, and ado-trastuzumab emtansine). This can lead to a problem called *congestive heart failure*. For most (but not all) women, this effect lasts a short time and gets better when the drug is stopped. The risk of heart problems is higher when if these drugs are given with certain chemo drugs that also can cause heart damage, such as doxorubicin (Adriamycin) and epirubicin (Ellence). Because these drugs can cause heart damage, doctors often check your heart function (with an echocardiogram or a MUGA scan) before treatment, and check it again every few months while you are taking the drug. Major symptoms of congestive heart failure are shortness of breath, leg swelling, and severe fatigue. Let your doctor know if you develop any of these symptoms.

Lapatinib can cause severe diarrhea, so it is very important to let your health care team know about any changes in bowel habits as soon as they happen. It can also cause something called hand-foot syndrome, in which that hands and feet become sore and red, and may blister and peel.

None of these drugs should be given to women who are pregnant because they can harm and even cause death to the fetus. Women who could become pregnant need to use effective birth control during treatment.

## **Drugs that help hormone therapy drugs work better**

**Palbociclib** (Ibrance<sup>®</sup>) is a drug that can be used along with an aromatase inhibitor to treat women with advanced hormone receptor-positive breast cancer. This drug blocks proteins in the cell called cyclin-dependent kinase (CDK) 4 and CDK6. In breast cancer cells that are hormone receptor positive, blocking these proteins helps stop the cells from dividing to make new cells. This slows cancer growth.

Palbociclib is a pill that is taken once a day for 3 weeks at a time, with a week off before starting again. It is approved to treat advanced hormone receptor-positive, HER2-negative, breast cancer in women who have gone through menopause.

Side effects tend to be mild and include low red blood cell counts (anemia), fatigue, nausea, mouth sores, hair loss, and diarrhea. Severe low white blood cell counts can also occur, which increase the risk of serious infection.

**Everolimus** (Afinitor<sup>®</sup>) is a drug that can be used along with a hormone therapy drug to treat women with advanced hormone receptor-positive breast cancer. This targeted therapy drug blocks mTOR, a protein in cells that normally promotes their growth and division. By blocking this protein, everolimus can help stop cancer cells from growing. Everolimus may also stop tumors from developing new blood vessels, which can help limit their growth. In treating breast cancer, this drug seems to help hormone therapy drugs work better.

Everolimus is a pill taken once a day.

This drug is approved to treat advanced hormone receptor–positive, HER2–negative, breast cancer in women who have gone through menopause. It is meant to be used with exemestane (Aromasin) in these women if their cancers have grown while they were being treated with either letrozole or anastrozole (or the cancer started growing shortly after treatment with these drugs was stopped). This approval was based on a study that showed that giving everolimus with exemestane was better than exemestane alone in shrinking tumors and stopping their growth in post-menopausal women with hormone receptor–positive, HER2–negative breast cancer that had stopped responding to letrozole or anastrozole.

Common side effects of this drug include mouth sores, diarrhea, nausea, fatigue, feeling weak or tired, low blood counts, shortness of breath, and cough. Everolimus can also increase blood lipids (cholesterol and triglycerides) and blood sugars, so your doctor will check your blood work periodically while you are on this drug. It can also increase your risk of serious infections, so your doctor will watch you closely for infection while you are on treatment.

Everolimus is also being studied for use for earlier stage breast cancer, with other hormone therapy drugs, and combination with other treatments. This is discussed further in the section “What’s new in breast cancer research and treatment?”

More information about monoclonal antibodies can be found in our document *Cancer Immunotherapy*.

For more information about targeted therapy drugs, see our document *Targeted Therapy*.

## Bone-directed therapy for breast cancer

When cancer spreads to bones, it can cause pain and lead to bones breaking (fractures) and other problems. Drugs like bisphosphonates and denosumab can lower the risk of these problems.

If you’d like more information on a drug used in your treatment or a specific drug mentioned in this section, see our Guide to Cancer Drugs, or call us with the names of the medicines you’re taking.

### **Bisphosphonates**

Bisphosphonates are drugs that can be used to help strengthen bones and reduce the risk of fractures and pain in bones that have been weakened by metastatic breast cancer. Examples include pamidronate (Aredia<sup>®</sup>) and zoledronic acid (Zometa<sup>®</sup>). They are given intravenously (IV).

Bisphosphonates may also help against bone thinning (osteoporosis) that can result from treatment with aromatase inhibitors or from early menopause as a side effect of chemotherapy. There are a number of medicines, including some oral forms of

bisphosphonates, to treat loss of bone strength when it is not caused by cancer spread to the bones.

Bisphosphonates can have side effects, including flu-like symptoms and bone pain. They can also lead to kidney problems, so people with poor kidney function may not be able to be treated with these drugs.

A rare but very distressing side effect of bisphosphonates is osteonecrosis (damage) in the jaw bones or ONJ. It can be triggered by having a tooth removed while getting treated with a bisphosphonate. ONJ often appears as an open sore in the jaw that won't heal. It can lead to loss of teeth or infections of the jaw bone. Doctors don't know why this happens or how to treat it, other than to stop the bisphosphonates. Maintaining good oral hygiene by flossing, brushing, making sure that dentures fit properly, and having regular dental checkups may help prevent this. Most doctors recommend that you have a dental checkup and have any tooth or jaw problems treated before starting bisphosphonate treatment.

## **Denosumab**

Denosumab (Xgeva<sup>®</sup>, Prolia<sup>®</sup>) is another drug that can help reduce the risk of problems from breast cancer metastasis to the bone. It works differently from bisphosphonates.

In studies of patients with breast cancer that had spread to the bone, it seemed to help prevent problems like fractures (breaks) better than zoledronic acid. It also can help bones even after bisphosphonates stop working.

In patients with cancer spread to bones, this drug is injected under the skin every 4 weeks. Side effects include low blood levels of calcium and phosphate, as well as ONJ. This drug does not seem to affect the kidneys, so it is safe to take if you have kidney problems.

Denosumab can also be used to strengthen bones in breast cancer patients with weak bones who are being treated with aromatase inhibitors. When it is used for this purpose, it is given less often (usually every 6 months).

For more information about treating cancer spread to bones, see our document *Bone Metastases*.

## **Clinical trials for breast cancer**

You may have had to make a lot of decisions since you've been told you have cancer. One of the most important decisions you will make is choosing which treatment is best for you. You may have heard about clinical trials being done for your type of cancer. Or maybe someone on your health care team has mentioned a clinical trial to you.

Clinical trials are carefully controlled research studies that are done with patients who volunteer for them. They are done to get a closer look at promising new treatments or procedures.

If you would like to take part in a clinical trial, you should start by asking your doctor if your clinic or hospital conducts clinical trials. You can also call our clinical trials matching service for a list of clinical trials that meet your medical needs. You can reach this service at 1-800-303-5691 or on our website at [www.cancer.org/clinicaltrials](http://www.cancer.org/clinicaltrials). You can also get a list of current clinical trials by calling the National Cancer Institute's Cancer Information Service toll-free at 1-800-4-CANCER (1-800-422-6237) or by visiting the NCI clinical trials website at [www.cancer.gov/clinicaltrials](http://www.cancer.gov/clinicaltrials).

There are requirements you must meet to take part in any clinical trial. If you do qualify for a clinical trial, you decide whether or not to enter (enroll in) it.

Clinical trials are one way to get state-of-the-art cancer treatment. They are the only way for doctors to learn better methods to treat cancer. Still, they are not right for everyone.

You can get a lot more information on clinical trials in our document called *Clinical Trials: What You Need to Know*.

## Complementary and alternative therapies for breast cancer

When you have cancer you are likely to hear about ways to treat your cancer or relieve symptoms that your doctor hasn't mentioned. Everyone from friends and family to Internet groups and web sites might offer ideas for what might help you. These methods can include vitamins, herbs, and special diets, or other methods such as acupuncture or massage, to name a few.

### **What exactly are complementary and alternative therapies?**

Not everyone uses these terms the same way, and they are used to refer to many different methods, so it can be confusing. We use *complementary* to refer to treatments that are used *along with* your regular medical care. *Alternative* treatments are used *instead of* a doctor's medical treatment.

**Complementary methods:** Most complementary treatment methods are not offered as cures for cancer. Mainly, they are used to help you feel better. Some methods that are used along with regular treatment are meditation to reduce stress, acupuncture to help relieve pain, or peppermint tea to relieve nausea. Some complementary methods are known to help, while others have not been tested. Some have been proven not to be helpful, and a few have even been found harmful.

**Alternative treatments:** Alternative treatments may be offered as cancer cures. These treatments have not been proven safe and effective in clinical trials. Some of these methods may pose danger, or have life-threatening side effects. But the biggest danger in

most cases is that you may lose the chance to be helped by standard medical treatment. Delays or interruptions in your medical treatments may give the cancer more time to grow and make it less likely that treatment will help.

## **Finding out more**

It is easy to see why people with cancer think about alternative methods. You want to do all you can to fight the cancer, and the idea of a treatment with few or no side effects sounds great. Sometimes medical treatments like chemotherapy can be hard to take, or they may no longer be working. But the truth is that most of these alternative methods have not been tested and proven to work in treating cancer.

As you consider your options, here are 3 important steps you can take:

- Look for "red flags" that suggest fraud. Does the method promise to cure all or most cancers? Are you told not to have regular medical treatments? Is the treatment a "secret" that requires you to visit certain providers or travel to another country?
- Talk to your doctor or nurse about any method you are thinking about using.
- Contact us at 1-800-227-2345 to learn more about complementary and alternative methods in general and to find out about the specific methods you are looking at. You can also find them in the "Complementary and Alternative Medicine" section of our website.

## **The choice is yours**

Decisions about how to treat or manage your cancer are always yours to make. If you want to use a non-standard treatment, learn all you can about the method and talk to your doctor about it. With good information and the support of your health care team, you may be able to safely use the methods that can help you while avoiding those that could be harmful.

## **Treatment of lobular carcinoma in situ**

Since lobular carcinoma in situ is not a true cancer or pre-cancer, often no immediate or active treatment is recommended. But because having LCIS increases your risk of developing invasive cancer later on, close follow-up is very important. This usually includes a yearly mammogram and a clinical breast exam. Close follow-up of both breasts is important because women with LCIS in one breast have the same increased risk of developing cancer in either breast. Although there is not enough evidence to recommend routine use of magnetic resonance imaging (MRI) in addition to mammograms for all women with LCIS, it is reasonable for these women to talk with their doctors about their other risk factors and the benefits and limits of being screened yearly with MRI.

Women with LCIS may also want to consider taking tamoxifen or raloxifene (Evista) to reduce their risk of breast cancer or taking part in a clinical trial for breast cancer prevention. (See our document *Medicines to Reduce Breast Cancer Risk*.) They might also wish to discuss other possible prevention strategies (such as reaching an optimal body weight or starting an exercise program) with their doctor.

A certain kind of LCIS, called *pleomorphic*, may be more likely to turn into invasive cancer than most kinds of LCIS. Some doctors feel that this kind of LCIS needs to be removed completely with surgery.

Because LCIS is linked to an increased risk of cancer in both breasts, some women with LCIS choose to have a bilateral simple mastectomy (removal of both breasts but not axillary lymph nodes) to lower this risk. This is more often considered if they have other risk factors for breast cancer, such as a strong family history. This may be followed by delayed breast reconstruction.

## Treatment of ductal carcinoma in situ

In most cases, a woman with DCIS can choose between breast-conserving surgery (BCS) and simple mastectomy. BCS is usually followed by radiation therapy. Lymph node removal (most often a sentinel lymph node biopsy) is not always needed. It may be done if the doctor thinks the area of DCIS may also contain invasive cancer. The risk of an area of DCIS containing invasive cancer goes up with tumor size and nuclear grade. Many doctors will do a sentinel lymph node biopsy if a mastectomy is done for DCIS. This is because if an area of invasive cancer is found in the tissue removed during a mastectomy, the doctor won't be able to go back and do a sentinel lymph node procedure later, and so may have to do a full axillary lymph node dissection.

Radiation therapy given after BCS lowers the chance of the cancer coming back in the same breast (as more DCIS or as an invasive cancer). BCS without radiation therapy is not a standard treatment, but might be an option for certain women who had small areas of low-grade DCIS that were removed with large enough cancer-free surgical margins. But most women who have BCS for DCIS will require radiation therapy.

Mastectomy may be necessary if the area of DCIS is very large, if the breast has several areas of DCIS, or if BCS cannot completely remove the DCIS (that is, the BCS specimen and re-excision specimens have cancer cells in or near the surgical margins). Women having a mastectomy for DCIS may choose to have reconstruction immediately or later.

If the DCIS is estrogen receptor–positive, treatment with tamoxifen for 5 years after surgery can lower the risk of another DCIS or invasive cancer developing in either breast. Women may want to discuss the pros and cons of this option with their doctors.

## Treatment of invasive breast cancer, by stage

Breast-conserving surgery (BCS) is often appropriate for earlier-stage invasive breast cancers if the cancer is small enough, although mastectomy is also an option. If the cancer is too large, a mastectomy will be needed, unless pre-operative (neoadjuvant) chemotherapy (chemo) can shrink the tumor enough to allow BCS. In either case, one or more underarm lymph nodes will need to be checked for cancer. Radiation will be needed for almost all women who have BCS and some who have mastectomy. Adjuvant systemic therapy after surgery is typically recommended for all cancers larger than 1 cm (about 1/2 inch) across, and also sometimes for smaller tumors. Many patients are treated with chemo before surgery (neoadjuvant chemo) rather than after surgery (adjuvant chemo).

If you'd like more information on a drug used in your treatment or a specific drug mentioned in this section, see our [Guide to Cancer Drugs](#), or call us with the names of the medicines you're taking.

### Stage I

These cancers are still relatively small and either have not spread to the lymph nodes (N0) or have a tiny area of cancer spread in the sentinel lymph node (N1mi).

**Local therapy:** Stage I cancers can be treated with either breast conserving surgery (BCS; sometimes called lumpectomy or partial mastectomy) or mastectomy. The lymph nodes will also need to be evaluated, either with a sentinel lymph node biopsy or an axillary lymph node dissection. Breast reconstruction can be done either at the same time as surgery or later.

Radiation therapy is usually given after BCS to lower the chance of the cancer coming back in the breast. Women may consider BCS *without* radiation therapy if they are at least 70 years old and ALL of the following are true:

- The tumor was 2 cm or less across and it has been completely removed.
- The tumor contains hormone receptors and hormone therapy is given.
- None of the lymph nodes removed contained cancer.

In women that meet these criteria, radiation after BCS still lowers the chance of the cancer coming back, but in studies it didn't help them live longer.

Some women who do not meet these criteria may be tempted to avoid radiation, but studies have shown that not getting radiation increases the chances of the cancer coming back which can shorten their lives.

**Adjuvant systemic therapy:** Most doctors will recommend adjuvant hormone therapy (either tamoxifen, an aromatase inhibitor, or one following the other) to all women who have a hormone receptor-positive (estrogen or progesterone) breast cancer, no matter

how small the tumor. Women with tumors larger than 0.5 cm (about ¼ inch) across may be more likely to benefit from it. Hormone therapy continues for at least 5 years.

If the tumor is smaller than 1 cm (about ½ inch) across, adjuvant chemo is not usually offered. Some doctors may suggest chemo if a cancer smaller than 1 cm has any unfavorable features (such as being high-grade, hormone receptor–negative, HER2-positive, or having a high score on a gene panel like Oncotype Dx). Adjuvant chemo is usually recommended for larger tumors.

For HER2-positive cancers, a year of adjuvant trastuzumab (Herceptin) is usually recommended as well.

See below for more information on adjuvant therapy.

## Stage II

These cancers are larger and/or have spread to a few nearby lymph nodes.

**Local therapy:** Stage II cancers are treated with surgery, either breast conserving surgery (BCS) or mastectomy. The lymph nodes will be checked, either with a sentinel lymph node biopsy or an axillary lymph node dissection. Women who had BCS, or who had large tumors (more than 5 cm across) or cancer cells in the lymph nodes, are treated with radiation therapy after surgery. If chemo is also needed after surgery, the radiation is delayed until the chemo is done.

In some cases, breast reconstruction can be done during the surgery to remove the cancer. But if you will need radiation after surgery, it is often better to delay reconstruction until after the radiation is complete.

**Systemic therapy:** Systemic therapy is recommended for women with stage II breast cancer. It may be hormone therapy, chemo, HER2 targeted drugs (such as trastuzumab and pertuzumab/Perjeta), or some combination of these, depending on the woman's age and the tumor's hormone-receptor status and HER2/neu status. Chemo can be given after surgery (adjuvant) or before surgery (neoadjuvant). Hormone therapy can be started before surgery (as neoadjuvant treatment), but since it continues for at least 5 years, it needs to be given after surgery as well. If the cancer is HER2 positive, HER2 targeted drugs are started with chemo. Both trastuzumab and pertuzumab may be used as a part neoadjuvant treatment. Then trastuzumab is continued after surgery for a total of one year of treatment.

Neoadjuvant treatments are good options for women with large tumors, because they can shrink the tumor before surgery, possibly enough to make BCS an option. But this doesn't improve survival more than giving the drugs after surgery.

See the following section for more information on adjuvant therapy.

## Stage III

For a cancer to be stage III, the tumor must be large (greater than 5 cm or about 2 inches across) or growing into nearby tissues (the skin over the breast or the muscle underneath), or the cancer has spread to many nearby lymph nodes.

Most often, these cancers are treated with chemo before surgery (neoadjuvant chemo). For HER2-positive tumors, the targeted drug trastuzumab is given as well, sometimes along with pertuzumab. This may shrink the tumor enough to allow breast conserving surgery (BCS). If the tumor doesn't shrink enough, a mastectomy is done. For stage III cancers, sentinel lymph node biopsy is often not an option, so an axillary lymph node dissection is done as well. Often, radiation therapy is needed after surgery. Breast reconstruction is usually delayed until after radiation is complete. In some cases, additional chemo is given after surgery as well. Women with HER2-positive cancers receive trastuzumab after surgery to complete a year of treatment. Women with hormone receptor-positive breast cancers will get adjuvant hormone therapy.

Another option for stage III cancers is to treat with surgery first. Because these tumors are fairly large and/or have grown into nearby tissues, this usually means a mastectomy. If the patient has fairly large breasts and the cancer hasn't grown into nearby tissues, BCS may be an option. Sentinel lymph node biopsy may be an option for some patients, but most require an axillary lymph node dissection. Surgery is usually followed by adjuvant systemic chemotherapy, and/or hormone therapy, and/or trastuzumab. Radiation is recommended after surgery.

Some inflammatory breast cancers are stage III. They are treated with neoadjuvant chemo (with trastuzumab and sometimes pertuzumab if the cancer is HER2-positive). If the cancer doesn't shrink with chemo, radiation may be given. This is followed by a mastectomy and axillary lymph node dissection. After surgery, radiation therapy is given (if it wasn't given before surgery). Women with hormone receptor-positive cancers are given hormone therapy after surgery, and those with HER2-positive cancers are given trastuzumab after surgery to complete a year of treatment. Some women may get additional chemo after surgery, but this is rare. Inflammatory breast cancer is discussed in more detail in our document *Inflammatory Breast Cancer*.

## Drug treatment for stages I to III breast cancer

Most women with breast cancer are treated with some kind of drug therapy. This may include chemo, HER2 targeted drugs, hormone therapy, or some combination of these.

**Chemotherapy:** Chemo is usually recommended for all women with an invasive breast cancer whose tumor is hormone receptor-negative, and for women with hormone receptor-positive tumors who might additionally benefit from having chemo along with their hormone therapy, based on the stage and characteristics of their tumor.

Chemo (either before or after surgery) can decrease the risk of the cancer coming back, but it does not remove the risk completely. Before deciding if it's right for you, it is important to understand the chance of your cancer returning and how much treatment will decrease that risk.

Your doctor should discuss what specific drug regimens are best for you based on your cancer, its stage, your other health issues, and your preferences. The typical chemo regimens are listed in the chemotherapy section. The length of treatment usually ranges from 3 to 6 months.

**Hormone therapy:** Hormone therapy is recommended to all women with hormone receptor–positive invasive breast cancer regardless of the size of the tumor or the number of lymph nodes with cancer cells. Hormone therapy is not likely to be effective for women with hormone receptor-negative tumors, so it is not offered to those women.

Women who have gone through menopause and who have hormone receptor–positive tumors will generally get adjuvant hormone therapy either with an aromatase inhibitor (such as anastrozole/Arimidex, letrozole/Femara, or exemestane/Aromasin) for 5 years. Another option is to take tamoxifen for 2 to 5 years followed by an aromatase inhibitor for 3 to 5 more years. For women who can't take aromatase inhibitors, an alternative is tamoxifen for 5 to 10 years. Aromatase inhibitors don't help if the ovaries are functioning (and producing estrogen), so women who had their uterus removed (a hysterectomy) but still have their ovaries may need to have blood tests to check hormone levels to see if they have gone through menopause before taking an aromatase inhibitor. Women who stopped having periods during or after chemo may also need their hormone levels tested to check for menopause in Many women whose periods stopped from chemo have not truly gone through menopause, and the periods will return.

For women who haven't gone through menopause, the most common treatment is tamoxifen, which block the effects of estrogen. This is taken for 5 to 10 years. Some doctors also give a luteinizing hormone-releasing hormone (LHRH) analog, which temporarily stops the ovaries from functioning. Another (permanent) option is surgical removal of the ovaries (oophorectomy). Still, it is not clear that removing the ovaries or stopping them from working helps tamoxifen work better for cancers that have been removed completely, so these treatments are not standard. If you become post-menopausal during tamoxifen treatment (either naturally or because your ovaries are removed), you may be switched from tamoxifen to an aromatase inhibitor. Still, women may stop having periods on tamoxifen without truly going through menopause, so blood tests of hormone levels are often needed to see if you are in menopause and can benefit from aromatase inhibitors. Another option for pre-menopausal women (instead of tamoxifen), is taking a LHRH analog to turn off the ovaries along with an aromatase inhibitor.

Getting hormone therapy and chemo together can make the chemo less effective, so hormone therapy is usually not started until after chemo is completed.

**HER2 targeted drugs:** Women who have HER2-positive cancers are usually given trastuzumab along with chemo as part of their treatment. If the treatment is given before surgery, pertuzumab may be given, as well. After the chemo is finished, the trastuzumab is continued to complete a year of treatment.

Because these drugs can lead to heart problems, heart function is watched closely during treatment with tests such as echocardiograms or MUGA scans.

**Online tools to help make decisions:** To decide if adjuvant therapy is right for you, you might want to visit the Mayo Clinic website at [www.mayoclinic.com](http://www.mayoclinic.com) and type "adjuvant therapy for breast cancer" into the search box. You will find a page that will help you to understand the possible benefits and limits of adjuvant therapy.

Other online guides, such as [www.adjuvantonline.com](http://www.adjuvantonline.com), are designed to be used by health care professionals. This website provides information about your risk of the cancer returning within the next 10 years and what benefits you might expect from hormone therapy and/or chemotherapy. You may want to ask your doctor if he or she uses this site.

## Stage IV

Stage IV cancers have spread beyond the breast and lymph nodes to other parts of the body. Breast cancer most commonly spreads to the bones, liver, and lung. As the cancer progresses, it may spread to the brain, but it can affect any organ, even the eye.

Although surgery and/or radiation may be useful in some situations (see below), systemic therapy is the main treatment. Depending on many factors, this may consist of hormone therapy, chemotherapy, targeted therapies, or some combination of these treatments. Treatment can shrink tumors, improve symptoms, and help patients live longer, but it isn't able to cure these cancers (make the cancer go away and stay away).

Patients with hormone receptor-positive cancers are often treated first with hormone therapy. Women who are post-menopausal may be treated first with palbociclib (Ibrance) along with a hormone drug like letrozole (Femara). Women who haven't yet gone through menopause are often treated first with tamoxifen. But because hormone therapy can take months to work, chemo is often the first treatment for patients with serious problems from their cancer spread, such as problems breathing.

Hormone therapy isn't helpful for hormone receptor-negative cancers, so chemo is the main treatment for women with these cancers.

Trastuzumab may help women with HER2-positive cancers live longer if it is given with the first chemo for stage IV disease. Trastuzumab can also be given with the hormone therapy drug letrozole. Other options include ado-trastuzumab emtansine (Kadcyla) or giving pertuzumab with chemo and trastuzumab. Treatment with ado-trastuzumab emtansine continues until the cancer starts growing again. It is not clear how long treatment with trastuzumab (with or without pertuzumab) should continue.

All of the systemic therapies given for breast cancer—hormone therapy, chemo, and targeted therapies—have possible side effects, which were described in previous sections. Your doctor will explain to you the benefits and risks of these treatments before prescribing them.

Radiation therapy and/or surgery may also be used in certain situations, such as:

- When the breast tumor is causing an open wound in the breast (or chest)
- To treat a small number of metastases in a certain area
- To prevent bone fractures
- When an area of cancer spread is pressing on the spinal cord
- To treat a blockage in the liver
- To provide relief of pain or other symptoms
- When the cancer has spread to the brain

If your doctor recommends such local treatments, it is important that you understand their goal—whether it is to try to cure the cancer or to prevent or treat symptoms.

In some cases, regional chemo (where drugs are delivered directly into a certain area, such as the fluid around the brain or into the liver) may be useful as well.

Treatment to relieve symptoms depends on where the cancer has spread. For example, pain from bone metastases may be treated with external beam radiation therapy and/or bisphosphonates such as pamidronate (Aredia) or zoledronic acid (Zometa). Most doctors recommend bisphosphonates or denosumab (Xgeva), along with calcium and vitamin D, for all patients whose breast cancer has spread to their bones. For more information about treatment of bone metastases, see our document *Bone Metastasis*.

**Advanced cancer that progresses during treatment:** Treatment for advanced breast cancer can often shrink the cancer or slow its growth (often for many years), but after a time, it stops working. Further treatment at this point depends on several factors, including previous treatments, where the cancer is located, and a woman's age, general health, and desire to continue getting treatment.

For hormone receptor-positive cancers that were being treated with hormone therapy, switching to another type of hormone therapy sometimes helps. If either letrozole (Femara) or anastrozole (Arimidex) were given, using everolimus (Afinitor) with exemestane may be an option. If hormone drugs stop working, chemo is usually the next step.

If the cancer is no longer responding to one chemo regimen, trying another may be helpful. Many different drugs and combinations can be used to treat breast cancer.

However, each time a cancer progresses during treatment it becomes less likely that further treatment will have an effect.

HER2-positive cancers that no longer respond to trastuzumab might respond to lapatinib. Lapatinib also attacks the HER2 protein. This drug is often given along with the chemotherapy drug capecitabine (Xeloda), but it can be used with other chemo drugs, with trastuzumab, or even alone (without chemo). Other options for women with HER2 positive cancers include giving pertuzumab with chemo and trastuzumab and using the drug ado-trastuzumab emtansine.

Because current treatments are very unlikely to cure advanced breast cancer, if you are in otherwise good health, you may want to think about taking part in clinical trials of other promising treatments.

## **Recurrent breast cancer**

Cancer is called *recurrent* when it come backs after treatment. Recurrence can be local (in the same breast or in the mastectomy scar) or in a distant area. Rarely, breast cancer comes back in nearby lymph nodes. This is called *regional* recurrence. Cancer that is found in the opposite breast is not a recurrence—it is a new cancer that requires its own treatment.

**Local recurrence:** For women whose breast cancer has recurred locally, treatment depends on their initial treatment. If you had breast-conserving surgery, a local recurrence in the breast is usually treated with mastectomy. If the initial treatment was mastectomy, recurrence near the mastectomy site is treated by removing the tumor whenever possible. This is followed by radiation therapy, but only if none had been given after the original surgery. (Radiation can't be given to the same area twice.) In either case, hormone therapy, targeted therapy (like trastuzumab), chemo, or some combination of these may be used after surgery and/or radiation therapy.

**Regional recurrence:** When breast cancer comes back in nearby lymph nodes (such as those under the arm or around the collar bone), it is treated by removing those lymph nodes. This may be followed by radiation treatments aimed at the area. Systemic treatment (like chemo, targeted therapy, or hormone therapy) may be considered after the local treatment as well.

**Distant recurrence:** In general, women whose cancer comes back in organs like the bones, lungs, brain, etc., are treated the same way as those found to have stage IV breast cancer in these organs when they were first diagnosed (see treatment for stage IV). The only difference is that treatment may be affected by previous treatments a woman has had.

Should your cancer come back, our document *When Your Cancer Comes Back: Cancer Recurrence* can provide you with more general information on how to manage and cope with this phase of your treatment.

## Treatment of breast cancer during pregnancy

Breast cancer is diagnosed in about 1 pregnant woman out of 3,000. In general, treatment recommendations depend upon how long the woman has been pregnant.

Radiation therapy during pregnancy is known to increase the risk of birth defects, so it is not recommended for pregnant women with breast cancer. Since breast-conserving surgery (BCS) needs to be followed with radiation, BCS is only an option if radiation can be delayed until after the baby is delivered. But breast biopsy procedures and even mastectomy and lymph node removal can be done safely in pregnancy.

For a long time it was assumed that chemotherapy (chemo) was dangerous to the fetus. But several studies have found that using certain chemo drugs during the second and third trimesters (the fourth to ninth months) does not increase the risk of birth defects. Because of concern about the potential damage to the fetus, the safety of chemo during the first trimester (the first 3 months) of pregnancy has not been studied.

Both hormone therapy and targeted therapy can affect the fetus and should not be started until after the baby is born.

Many chemo and hormone therapy drugs can enter breast milk and could be passed on to the baby, so breastfeeding is not usually recommended during chemo, hormone, or targeted therapy.

If you'd like more information on a drug used in your treatment, see our [Guide to Cancer Drugs](#), or call us with the names of the medicines you're taking.

For more information, see our document *Pregnancy and Breast Cancer*.

## More treatment information for breast cancer

For more details on treatment options—including some that may not be addressed in this document—the National Cancer Institute (NCI) and the National Comprehensive Cancer Network (NCCN) are good sources of information.

The NCI provides treatment guidelines via its telephone information center (1-800-4-CANCER) and its website ([www.cancer.gov](http://www.cancer.gov)). Detailed guidelines intended for use by cancer care professionals are also available on [www.cancer.gov](http://www.cancer.gov).

The NCCN, made up of experts from many of the nation's leading cancer centers, develops cancer treatment guidelines for doctors to use when treating patients. Those are available on the NCCN website ([www.nccn.org](http://www.nccn.org)).

# What should you ask your doctor about breast cancer?

It is important for you to have frank, open discussions with your cancer care team. Don't be afraid to ask questions, no matter how minor you might think they are. Some questions to consider:

- What type of breast cancer do I have? How does this affect my treatment options and prognosis?
- Has my cancer spread to lymph nodes or internal organs?
- What is the stage of my cancer and how does it affect my treatment options and outlook?
- Do I need to have other tests done before we can decide on treatment?
- Should I consider genetic testing?
- Should I think about taking part in a clinical trial?
- What treatments are appropriate for me? What do you recommend? Why?
- What are the risks and side effects that I should expect?
- How effective will breast reconstruction surgery be if I need or want it?
- What are the pros and cons of having it done right away or waiting until later?
- What will my breasts look and feel like after my treatment? Will I have normal sensation in them?
- How long will treatment last? What will it be like? Where will it be done?
- What should I do to get ready for treatment?
- Will I need a blood transfusion?
- Should I follow a special diet or make other lifestyle changes?
- What are the chances my cancer will come back with the treatment programs we have discussed? What would we do if that happens?
- Will I go through menopause as a result of the treatment?
- Will I be able to have children after my treatment?
- What type of follow-up will I need after treatment?

Be sure to write down any questions that occur to you that are not on this list. For instance, you might want specific information about recovery times so that you can plan your work schedule. Or you may want to ask about second opinions. Taking another person and/or a tape recorder to the appointment can be helpful. Collecting copies of your medical records, pathology reports, and radiology reports may be useful in case you wish to seek a second opinion at a later time.

## What happens after treatment for breast cancer?

For many women with breast cancer, treatment may remove or destroy the cancer. Completing treatment can be both stressful and exciting. You may be relieved to finish treatment, but find it hard not to worry about cancer coming back. (When cancer comes back after treatment, it is called *recurrence*.) This is a very common concern in people who have had cancer.

It may take a while before your fears lessen. But it may help to know that many cancer survivors have learned to live with this uncertainty and are leading full lives. Our document *Living with Uncertainty: The Fear of Cancer Recurrence* gives more detailed information on this.

For other people, the cancer may never go away completely. These people may get regular treatments with chemotherapy, radiation therapy, or other treatments to try to help keep the cancer in check. Learning to live with cancer that does not go away can be difficult and very stressful. It has its own type of uncertainty. Our document *When Cancer Doesn't Go Away* talks more about this.

## Follow-up care

When treatment ends, your doctors will still want to watch you closely. It is very important to go to all of your follow-up appointments. During these visits, your doctors will ask questions about any problems you may have and may do exams and lab tests or x-rays and scans to look for signs of cancer or treatment side effects.

Almost any cancer treatment can have side effects. Some may last for a few weeks to months, but others can last the rest of your life. This is the time for you to talk to your cancer care team about any changes or problems you notice and any questions or concerns you have.

At first, your follow-up appointments will probably be scheduled for every 3 to 6 months. The longer you have been free of cancer, the less often the appointments are needed. After 5 years, they are typically done about once a year. If you had breast-conserving surgery, you will get a mammogram about 6 months after surgery and radiation are

completed, and then at least every year. Women who had a mastectomy should continue to have yearly mammograms on the remaining breast.

If you are taking tamoxifen or toremifene, you should have pelvic exams every year because these drugs can increase your risk of uterine cancer. This risk is highest in women who have gone through menopause. Be sure to tell your doctor right away about any abnormal vaginal bleeding, such as vaginal bleeding or spotting after menopause, bleeding or spotting between periods, or a change in your periods. Although this is usually caused by a non-cancerous condition, it can also be the first sign of uterine cancer.

If you are taking an aromatase inhibitor for early stage breast cancer, your doctor will want to monitor your bone health and may consider testing your bone density.

Other tests such as blood tumor marker studies, blood tests of liver function, CTs, bone scans, and chest x-rays are not a standard part of follow-up because they don't help a woman treated with breast cancer live longer. But they will be done (as indicated) if you have symptoms or physical exam findings that suggest that the cancer has recurred. These and other tests may also be done as part of evaluating new treatments by clinical trials.

If symptoms, exams, or tests suggest a recurrence, imaging tests such as an x-ray, CT scan, PET scan, MRI scan, bone scan, and/or a biopsy may be done. Your doctor may also look for circulating tumor cells in the blood or measure levels of blood tumor markers such as CA-15-3, CA 27-29, or CEA. The blood levels of tumor markers go up in some women if their cancer has spread to bones or other organs such as the liver. They are not elevated in all women with recurrence, so they aren't always helpful. If they are elevated, your doctor might use them to monitor the results of therapy.

If cancer does recur, your treatment will depend on the location of the cancer and what treatments you've had before. It may mean surgery, radiation therapy, hormone therapy, chemotherapy, targeted therapy, or some combination of these. For more information on how recurrent cancer is treated, see the section "Treatment of invasive breast cancer, by stage." For more general information on dealing with a recurrence, see our document *When Your Cancer Comes Back: Cancer Recurrence*.

It is also important to keep health insurance. Tests and doctor visits cost a lot, and even though no one wants to think of their cancer coming back, this could happen.

## Lymphedema after breast cancer treatment

Lymphedema, or swelling of the arm from buildup of fluid, may occur any time after treatment for breast cancer. Any treatment that removes the axillary lymph nodes or gives radiation to the axillary lymph nodes carries the risk of lymphedema because normal drainage of lymph fluid from the arm is changed.

One of the first symptoms of lymphedema may be a feeling of tightness in the arm or hand on the same side that was treated for breast cancer. Any swelling, tightness, or injury to the arm or hand should be reported promptly to your doctor or nurse.

There is no good way to predict who will and will not develop lymphedema. It can occur right after surgery, or months, or even years later. The possibility of developing lymphedema remains throughout a woman's lifetime.

With care, lymphedema can often be avoided or, if it develops, kept under control. Injury or infection involving the affected arm or hand can contribute to the development of lymphedema or make existing lymphedema worse, so preventive measures should focus on protecting the arm and hand. Most doctors recommend that women avoid having blood drawn from or blood pressures taken on the arm on the side of the lymph node surgery or radiation.

To learn more, see our document *Lymphedema: What Every Woman with Breast Cancer Should Know*.

## Emotional aspects of breast cancer

It is important that your focus on tests and treatments does not prevent you from considering your emotional, psychological, and spiritual health as well. Once your treatment ends, you may find yourself overwhelmed by emotions. This happens to a lot of people. You may have been going through so much during treatment that you could only focus on getting through your treatment.

Now you might find that you think about the possibility of your own death, or the effect of your cancer on your family, friends, and career. You may also begin to re-evaluate your relationship with your spouse or partner. Unexpected issues may also cause concern—for instance, as you become healthier and have fewer doctor visits, you will see your health care team less often. That can be a source of anxiety for some.

This is an ideal time to seek out emotional and social support. You need people you can turn to for strength and comfort. Support can come in many forms: family, friends, cancer support groups, church or spiritual groups, online support communities, or individual counselors.

Almost everyone who has been through cancer can benefit from getting some type of support. What's best for you depends on your situation and personality. Some people feel safe in peer-support groups or education groups. Others would rather talk in an informal setting, such as church. Others may feel more at ease talking one-on-one with a trusted friend or counselor. Whatever your source of strength or comfort, make sure you have a place to go with your concerns.

The cancer journey can feel very lonely. It is not necessary or realistic to go it all by yourself. And your friends and family may feel shut out if you decide not to include

them. Let them in—and let in anyone else who you feel might help. If you aren't sure who can help, call your American Cancer Society at 1-800-227-2345 and we can put you in touch with an appropriate group or resource. You may also want to see our document *Distress in People with Cancer* for more information.

## **In younger women**

Some studies suggest that younger women, who represent about 1 out of 4 breast cancer survivors, tend to have more problems adjusting to the stresses of breast cancer and its treatment. They may have more trouble with emotional and social functioning. Some can feel isolated. For some women, chemotherapy may have caused early menopause, which can be very distressing on its own. There may also be sexual difficulties. These issues may be helped with counseling and support groups directed at younger breast cancer survivors.

## **Body image after breast cancer treatment**

Along with having to cope with the emotional stress that cancer and its treatment can cause, many women with breast cancer also find themselves dealing with changes in their appearance as a result of their treatment.

Some changes may be short term, such as hair loss. But even short-term changes can have a profound effect on how a woman feels about herself. A number of options are available to help women cope with hair loss, including wigs, hats, scarves, and other accessories. For a list of some companies that sell wigs and other hair accessories, see our document *Breast Protheses and Hair Loss Accessories List*. Alternatively, some women may choose to use their baldness as a way to identify themselves as breast cancer survivors.

Other changes are more permanent, like the loss of part or all of a breast (or breasts) after surgery. Some women may choose reconstructive surgery to address this, while others may opt for a breast form.

Regardless of the changes you may experience, it's important to know that there is advice and support out there to help you cope with these changes. Speaking with your doctor or other members of your health care team is often a good starting point. There are also many support groups available, such as the American Cancer Society's Reach To Recovery program. Call 1-800-227-2345 or visit our website to learn more about programs in your area.

## **Breast forms and bras vs. breast reconstruction**

After a mastectomy, you may consider having the breast mound rebuilt or reconstructed. This is usually something that is discussed before surgery to treat the cancer. Decisions about the type of reconstruction and when it will be done depend on each woman's

medical situation and personal preferences. There are several types of reconstructive surgery available. Some use saline (saltwater) or silicone implants, while others use tissues from other parts of your body. You may also consider some type of reconstruction if you had breast-conserving surgery. Sometimes tissue from the other breast is removed so that the breasts look more symmetrical (even).

For a discussion of the different breast reconstruction options, see our document *Breast Reconstruction After Mastectomy*.

A *breast form* is a prosthesis (artificial body part) worn either inside a bra or attached to the body to simulate the appearance and feel of a natural breast. For women who have had a mastectomy, breast forms can be an important alternative to breast reconstruction. Some women might not want further surgery, knowing that breast reconstruction can sometimes require several procedures to complete.

If you are planning on using a breast form, your doctor will tell you when you have healed enough to be fitted for a permanent breast form or prosthesis. Most of these forms are made from materials that mimic the movement, feel, and weight of natural tissue. A properly weighted form provides the balance your body needs for correct posture and anchors your bra, keeping it from riding up.

At first, these forms may feel too heavy, but in time they will feel natural. Prices vary considerably. High price doesn't necessarily mean that the product is the best for you. Take time to shop for a good fit, comfort, and an attractive, natural appearance in the bra and under clothing. Your clothes should fit the way they did before surgery.

The right bra for you may very well be the one you have always worn. It may or may not need adjustments. If there is tenderness during healing, a bra extender can help by increasing the circumference of the bra so that it does not bind the chest too tightly. Heavy-breasted women can relieve pressure on shoulder straps by slipping a bra shoulder pad under one or both straps.

If you decide to wear your breast form in a pocket in your bra, you can have your regular bra adapted. There are also special mastectomy bras with the pockets already sewn in. If the breast form causes any kind of skin irritation, use a bra with a pocket. If your bra has underwires, you may be able to wear it, but be sure to clear this with your doctor.

You might want to wear your prosthesis under nightgowns but would like something more comfortable than a regular bra. Most department stores carry a soft bra, sometimes called a *leisure* or *night* bra.

For a list of companies that sell breast prostheses and other accessories, see our document *Breast Prostheses and Hair Loss Accessories List*.

Insurance coverage of breast prostheses can vary. Be sure to read your insurance policy to see what is covered and how you must submit claims. Also, ask your doctor to write prescriptions for your prosthesis and for any special mastectomy bras. When purchasing

bras or breast forms, mark the bills and any checks you write "surgical." Medicare and Medicaid can be used to pay for some of these expenses if you are eligible. The cost of breast forms and bras with pockets may be tax deductible, as may the cost if you have a bra altered. Keep careful records of all related expenses.

Some insurance companies will not cover both a breast prosthesis and reconstructive surgery. That can mean that if you submit a claim for a prosthesis or bra to your insurance company, in some cases the company **will not** cover reconstruction, should you choose this procedure in the future. Make sure you get all the facts before submitting any insurance claims.

If you have questions, call your local ACS Reach To Recovery volunteer. She will give you suggestions, additional reading material, and advice. Remember that she's been there and will probably understand.

## Sexuality after breast cancer

You may have concerns about sexuality after breast cancer. Physical changes (such as those after surgery) make some women less comfortable with their bodies. Some treatments for breast cancer, such as chemotherapy, can change your hormone levels and may negatively affect sexual interest and/or response. For women in their 20s or 30s who may be focused on choosing a partner or having children, a diagnosis of breast cancer can be especially difficult.

### **Sexual impact of surgery and radiation**

Breast cancer treatments like surgery and radiation can damage to a woman's feelings of attractiveness. In our culture, we are taught to view breasts as a basic part of beauty and femininity. If a breast has been removed, a woman may worry about whether her partner will still find her attractive. She may also be worried about not being able to enjoy sexual stimulation in the affected breast.

Even after having a breast removed, some women still enjoy being stroked around the area of the healed scar. Others dislike being touched there and may no longer even enjoy being touched on the remaining breast and nipple. Some women who have had a mastectomy may feel self-conscious in certain sexual positions where the area of the missing breast is more visible.

Although there may be emotional effects, breast surgery or radiation to the breasts does not physically decrease a woman's sexual desire. Nor does it decrease her ability to have vaginal lubrication or normal genital feelings, or to reach orgasm. And according to recent research, most women with early-stage breast cancer have good emotional adjustment and sexual satisfaction within a year after their surgery. They report a quality of life similar to women who never had cancer.

A few women have chronic pain in their chests and shoulders after surgery. During intercourse, supporting these areas with pillows and avoiding positions where your weight rests on your chest or arms may help.

If you had breast-conserving surgery followed by radiation therapy, the breast may be scarred. It also may be a different shape or size. During radiation therapy, the skin may become red and swollen, and the breast may be a little tender. This improves over time after radiation is finished.

## **Sexual impact of breast reconstruction**

Breast reconstruction restores the shape of the breast, but it cannot restore normal breast sensation. The nerve that supplies feeling to the nipple runs through the deep breast tissue, and it gets disconnected during surgery. In a reconstructed breast, the feeling of pleasure from having the nipple touched is lost. A rebuilt nipple has much less feeling.

In time, the skin on the reconstructed breast will regain some sensitivity but probably will not give the same kind of pleasure as before mastectomy.

## **Effect on your partner**

Relationship issues are also important because the cancer diagnosis can be very distressing for the partner, as well as the patient. Partners are usually concerned about how to express their love physically and emotionally after treatment, especially surgery. But breast cancer can be a growth experience for couples – especially when partners take part in decision-making and go along to treatments.

More information about this can be found in our document *Sexuality for the Woman with Cancer*.

## **Pregnancy after breast cancer**

Some treatments for breast cancer, such as certain chemo drugs, may affect a woman's ability to have a baby (fertility). Still, many women are able to become pregnant after treatment. The best time to talk with your doctor about fertility is **before** starting breast cancer treatment.

Because many breast cancers are sensitive to estrogen, there has been concern that if a woman has been treated for breast cancer, high hormone levels during pregnancy might increase the chance of the cancer coming back. Studies have shown, though, that pregnancy does not increase the risk of the cancer coming back after successful treatment.

Still, many doctors advise breast cancer survivors to wait at least 2 years after all treatment has finished before trying to get pregnant, though the best length of time to wait

is not clear. Two years is thought to give them the chance to find any early return of the cancer, which could affect a woman's decision to become pregnant. Still, this advice is not based on data from any clinical trials. And some studies point out that breast cancer can come back after the 2-year mark, so every case is different. Each woman's decision is based on many things, such as her age, fertility, desire for more pregnancies, type of breast cancer, risk of an early relapse, and the potential effect estrogen may have on her risk of a breast cancer coming back.

Women taking chemotherapy, hormone therapy, or targeted therapy should talk with their doctors before trying to become pregnant. These drugs could affect a growing fetus, so it isn't safe to get pregnant until all treatment is complete. Stopping treatment early can increase the risk of the cancer growing or coming back.

There is no proof that a woman's past breast cancer has any direct effect on her baby. Researchers have found no increased rate of birth defects or other long-term health concerns in children born to women who have had breast cancer.

There's also no proof that breastfeeding after breast cancer treatment shortens survival. But women who have had breast surgery and/or radiation should know that they may have problems breastfeeding from the affected breast. Studies have shown reduced milk production in that breast as well as structural changes that can make it difficult and painful for the baby to latch onto the breast.

Another important thing to remember is that chemotherapy for breast cancer also can damage the ovaries, sometimes causing immediate or delayed infertility. Cancer treatment can also cause women to delay trying to get pregnant. These factors together often mean that a woman has less chance of getting pregnant after breast cancer treatment. For more about how cancer treatment can affect fertility, see our document called [\*Fertility and Women With Cancer\*](#).

All women who have or have had had breast cancer and are thinking about having children should talk with their doctors about how treatment could affect their chances for pregnancy. This discussion should also cover the risk of the cancer coming back. In many cases, counseling can help women sort through the choices that come with surviving breast cancer and planning a pregnancy.

## Post-menopausal hormone therapy after breast cancer

The known link between estrogen levels and breast cancer growth has discouraged many women and their doctors from choosing or recommending post-menopausal hormone therapy (PHT), also called hormone replacement therapy (HRT), to help relieve menopausal symptoms.

Unfortunately, many women experience menopausal symptoms after treatment for breast cancer. This can happen naturally, as a result of post-menopausal women stopping PHT,

or in pre-menopausal women as a result of chemotherapy or ovarian ablation. Tamoxifen and aromatase inhibitors can also cause menopausal symptoms such as hot flashes.

In the past, doctors have offered PHT after breast cancer treatment to women suffering from severe symptoms because early studies had shown no harm. But a well-designed clinical trial (the HABITS study) found that breast cancer survivors taking PHT were much more likely to develop a new or recurrent breast cancer than women who were not taking the drugs. This is why most doctors now feel that if a woman was previously treated for breast cancer, taking PHT would be unwise.

Women might want to discuss with their doctors alternatives to PHT to help with specific menopausal symptoms. Some doctors have suggested that phytoestrogens (estrogen-like substances from certain plant sources, such as soy products) may be safer than the estrogens used in PHT. However, although eating soy foods seems to be safe for breast cancer survivors, there is not enough information available on phytoestrogen supplements to fully evaluate their safety.

Drugs without hormonal properties that may be somewhat effective in treating hot flashes include the antidepressant venlafaxine (Effexor<sup>®</sup>), the blood pressure drug clonidine, and the nerve drug gabapentin (Neurontin<sup>®</sup>). Acupuncture also seems to be helpful in treating hot flashes. For women taking tamoxifen, it's important to note that some antidepressants, known as *SSRIs*, may interact with tamoxifen and could make it less effective. Ask your doctor about any possible interactions between tamoxifen and any drugs you may be taking.

## Seeing a new doctor after breast cancer treatment

At some point after your cancer diagnosis and treatment, you may find yourself seeing a new doctor who does not know anything about your medical history. It is important that you be able to give your new doctor the details of your diagnosis and treatment. Gathering these details soon after treatment may be easier than trying to get them at some point in the future. Make sure you have the following information handy:

- A copy of your pathology report(s) from any biopsies or surgeries
- If you had surgery, a copy of your operative report(s)
- If you were in the hospital, a copy of the discharge summary that doctors prepare when patients are sent home
- If you had radiation therapy, a copy of your treatment summary
- If you had systemic therapy (hormone therapy, chemotherapy, or targeted therapy), a list of your drugs, drug doses, and when you took them

The doctor may want copies of this information for his records, but always keep copies for yourself.

## Can I get another cancer after having breast cancer?

Cancer survivors can be affected by a number of health problems, but often their greatest concern is facing cancer again. If a cancer comes back after treatment it is called a “recurrence.” But some cancer survivors may develop a new, unrelated cancer later. This is called a “second cancer.” No matter what type of cancer you have had, it is still possible to get another (new) cancer, even after surviving the first.

Unfortunately, being treated for cancer doesn’t mean you can’t get another cancer. People who have had cancer can still get the same types of cancers that other people get. In fact, certain types of cancer and cancer treatments can be linked to a higher risk of certain second cancers.

Women who have had breast cancer can get any type of second cancer, but they have an increased risk of:

- A second breast cancer (this is different than the first cancer coming back)
- Salivary gland cancer
- Esophagus cancer
- Stomach cancer
- Colon cancer
- Uterine cancer
- Ovarian cancer
- Thyroid cancer
- Soft tissue cancer
- Melanoma of the skin
- Acute myeloid leukemia (AML)

The most common second cancer seen in survivors of breast cancer is another breast cancer. The new cancer can occur in the opposite breast, as well as in the same breast for women who were treated with breast-conserving surgery (such as a lumpectomy). The risk of a second breast cancer is increased no matter what treatment is used for the first cancer, so it is likely linked to the same thing that caused the first cancer, like genetics or a hormonal risk factor.

For some second cancers, shared genetic risk factors may play a role. For example, women with mutations in the *BRCA* genes have a high increased risk of both ovarian cancer and breast cancer.

### **Cancers linked to radiation treatment**

The risk of lung cancer is not increased overall after breast cancer, but it is increased in women who had radiation therapy for breast cancer. The higher lung cancer risk is first seen 10 years after radiation, and gets higher over time. The risk of lung cancer after radiation is even higher in women who smoke.

Radiation therapy to the breast also increases the risk of sarcomas of blood vessels (angiosarcomas), bone (osteosarcomas), and other connective tissues. These cancers are most often seen in the remaining breast area, chest wall, or in the arm that had been treated with the radiation therapy. This risk remains high even 30 years after treatment.

Breast radiation is linked to a higher risk of leukemia and myelodysplastic syndrome. Overall, though, the risk is low – less than half a percent.

### **Cancers linked to chemotherapy**

There is a small risk of developing leukemia and myelodysplastic syndrome after chemotherapy for early breast cancer. The risk is higher if both chemotherapy and radiation therapy are given. Some studies found the highest risk in patients treated with chemotherapy drugs known as alkylating agents. The chemo drug, cyclophosphamide (Cytosan<sup>®</sup>), which is commonly used to treat early breast cancer is an alkylating agent. The risk of leukemia and myelodysplastic syndrome with cyclophosphamide treatment is goes up as the amount of the drug given goes up and as dose intensity increases (when doses of the drug are given closer together). Still, a recent study found a low overall risk of leukemia and myelodysplastic syndrome of about half of one percent.

### **Cancers linked to treatment with tamoxifen**

Taking tamoxifen lowers the chance of hormone receptor-positive breast cancer coming back. It also lowers the risk of a second breast cancer. Tamoxifen does, however, increase the risk for uterine cancer (endometrial cancer and uterine sarcoma). Still, the overall risk of uterine cancer in most women taking tamoxifen is low, and studies have shown that the benefits of this drug in treating breast cancer are greater than the risk of a second cancer.

### **Follow-up care**

After completing treatment for breast cancer, you should still see your doctor regularly to look for signs that the cancer has come back or spread. If you have not had both breasts

removed, you need annual mammograms to screen for breast cancer. You should also follow the American Cancer Society guidelines for the early detection of cancer, such as those for colorectal cancer and cervical cancer. Experts do not recommend any additional testing to look for second cancers unless you have symptoms.

Let your doctor know about any new symptoms or problems, because they could be caused by the cancer coming back or by a new disease or second cancer. For example, abnormal menstrual bleeding, such as bleeding or spotting after menopause or between periods can be a symptom of uterine cancer.

Survivors of breast cancer should stay away from tobacco products. Smoking increases the risk of many cancers and might further increase the risk of some of the second cancers seen after breast cancer.

To help maintain good health, survivors should also:

- Achieve and maintain a healthy weight
- Adopt a physically active lifestyle
- Consume a healthy diet, with an emphasis on plant foods
- Limit consumption of alcohol to no more than 1 drink per day

These steps may also lower the risk of some cancers.

See *Second Cancers in Adults* for more information about causes of second cancers.

## Lifestyle changes after breast cancer treatment

You can't change the fact that you have had cancer. What you can change is how you live the rest of your life – making choices to help you stay healthy and feel as well as you can. This can be a time to look at your life in new ways. Maybe you are thinking about how to improve your health over the long term. Some people even start during cancer treatment.

### **Making healthier choices**

For many people, a diagnosis of cancer helps them focus on their health in ways they may not have thought much about in the past. Are there things you could do that might make you healthier? Maybe you could try to eat better or get more exercise. Maybe you could cut down on alcohol, or give up tobacco. Even things like keeping your stress level under control may help. Now is a good time to think about making changes that can have positive effects for the rest of your life. You will feel better and you will also be healthier.

You can start by working on those things that worry you most. Get help with those that are harder for you. For instance, if you are thinking about quitting smoking and need

help, call the American Cancer Society for information and support. This tobacco cessation and coaching service can help increase your chances of quitting for good.

## **Eating better**

Eating right can be hard for anyone, but it can get even tougher during and after cancer treatment. Treatment may change your sense of taste. Nausea can be a problem. You may not feel like eating and lose weight when you don't want to. Or you may have gained weight that you can't seem to lose. All of these things can be very frustrating.

If treatment caused weight changes or eating or taste problems, do the best you can and keep in mind that these problems usually get better over time. You may find it helps to eat small portions every 2 to 3 hours until you feel better. You may also want to ask your cancer team about seeing a dietitian, an expert in nutrition who can give you ideas on how to deal with these treatment side effects.

One of the best things you can do after cancer treatment is put healthy eating habits into place. You may be surprised at the long-term benefits of some simple changes, like increasing the variety of healthy foods you eat. Getting to and staying at a healthy weight, eating a healthy diet, and limiting your alcohol intake may lower your risk for a number of types of cancer, as well as having many other health benefits.

## **Rest, fatigue, and exercise**

Extreme tiredness, called fatigue, is very common in people treated for cancer. This is not a normal tiredness, but a "bone-weary" exhaustion that doesn't get better with rest. For some people, fatigue lasts a long time after treatment, and can make it hard for them to exercise and do other things they want to do. But exercise can help reduce fatigue. Studies have shown that patients who follow an exercise program tailored to their personal needs feel better physically and emotionally and can cope better, too.

If you were sick and not very active during treatment, it is normal for your fitness, endurance, and muscle strength to decline. Any plan for physical activity should fit your own situation. A person who never exercises will not be able to take on the same amount of exercise as someone who plays tennis twice a week. If you haven't exercised in a few years, you will have to start slowly – maybe just by taking short walks. You can read more in our document *Nutrition and Physical Activity During and After Cancer Treatment: Answers to Common Questions*.

Talk with your health care team before starting anything. Get their opinion about your exercise plans. Then, try to find an exercise buddy so you're not doing it alone. Having family or friends involved when starting a new exercise program can give you that extra boost of support to keep you going when the push just isn't there.

If you are very tired, you will need to balance activity with rest. It is OK to rest when you need to. Sometimes it's really hard for people to allow themselves to rest when they are used to working all day or taking care of a household, but this is not the time to push yourself too hard. Listen to your body and rest when you need to. For more information on dealing with fatigue, see *Fatigue in People With Cancer* and *Anemia in People With Cancer*.

Keep in mind exercise can improve your physical and emotional health.

- It improves your cardiovascular (heart and circulation) fitness.
- Along with a good diet, it will help you get to and stay at a healthy weight.
- It makes your muscles stronger.
- It reduces fatigue and helps you have more energy.
- It can help lower anxiety and depression.
- It can make you feel happier.
- It helps you feel better about yourself.

And long term, we know that getting regular physical activity plays a role in helping to lower the risk of some cancers, as well as having other health benefits.

## **If treatment for breast cancer stops working**

If cancer keeps growing or comes back after one kind of treatment, it is possible that another treatment plan might still cure the cancer, or at least shrink it enough to help you live longer and feel better. But when a person has tried many different treatments and the cancer has not gotten any better, the cancer tends to become resistant to all treatment. If this happens, it's important to weigh the possible limited benefits of a new treatment against the possible downsides. Everyone has their own way of looking at this.

This is likely to be the hardest part of your battle with cancer—when you have been through many medical treatments and nothing's working anymore. Your doctor may offer you new options, but at some point you may need to consider that treatment is not likely to improve your health or change your outcome or survival.

If you want to continue to get treatment for as long as you can, you need to think about the odds of treatment having any benefit and how this compares to the possible risks and side effects. In many cases, your doctor can estimate how likely it is the cancer will respond to treatment you are considering. For instance, the doctor may say that more chemo or radiation might have about a 1 in 100 chance of working. Some people are still tempted to try this. But it is important to think about and understand your reasons for choosing this plan.

No matter what you decide to do, you need to feel as good as you can. Make sure you are asking for and getting treatment for any symptoms you might have, such as nausea or pain. This type of treatment is called *palliative care*.

Palliative care helps relieve symptoms, but is not expected to cure the disease. It can be given along with cancer treatment, or can even be cancer treatment. The difference is its purpose—the main purpose of palliative care is to improve the quality of your life, or help you feel as good as you can for as long as you can. Sometimes this means using drugs to help with symptoms like pain or nausea. Sometimes, though, the treatments used to control your symptoms are the same as those used to treat cancer. For instance, radiation might be used to help relieve bone pain caused by cancer that has spread to the bones. Or chemo might be used to help shrink a tumor and keep it from blocking the bowels. But this is not the same as treatment to try to cure the cancer. You can learn more about the changes that occur when curative treatment stops working, and about planning ahead for yourself and your family, in our documents called *Nearing the End of Life* and *Advance Directives*.

At some point, you may benefit from hospice care. This is special care that treats the person rather than the disease; it focuses on quality rather than length of life. Most of the time, it is given at home. Your cancer may be causing problems that need to be managed, and hospice focuses on your comfort. You should know that while getting hospice care often means the end of treatments such as chemo and radiation, it doesn't mean you can't have treatment for the problems caused by your cancer or other health conditions. In hospice the focus of your care is on living life as fully as possible and feeling as well as you can at this difficult time. You can learn more about hospice in our document called *Hospice Care*.

Staying hopeful is important, too. Your hope for a cure may not be as bright, but there is still hope for good times with family and friends—times that are filled with happiness and meaning. Pausing at this time in your cancer treatment gives you a chance to refocus on the most important things in your life. Now is the time to do some things you've always wanted to do and to stop doing the things you no longer want to do. Though the cancer may be beyond your control, there are still choices you can make.

## **What's new in breast cancer research and treatment?**

Research into the causes, prevention, and treatment of breast cancer is being done in many medical centers throughout the world.

## Causes of breast cancer

Studies continue to uncover lifestyle factors and habits that alter breast cancer risk. Ongoing studies are looking at the effect of exercise, weight gain or loss, and diet on breast cancer risk.

Studies on the best use of genetic testing for *BRCA1* and *BRCA2* mutations continue at a rapid pace. Scientists are also exploring how common gene variations may affect breast cancer risk. Each gene variant has only a modest effect in risk (10 to 20%), but when taken together they may potentially have a large impact.

Potential causes of breast cancer in the environment have also received more attention in recent years. While much of the science on this topic is still in its earliest stages, this is an area of active research.

A large, long-term study funded by the National Institute of Environmental Health Sciences (NIEHS) is now being done to help find the causes of breast cancer. Known as the Sister Study, it has enrolled 50,000 women who have sisters with breast cancer. This study will follow these women for at least 10 years and collect information about genes, lifestyle, and environmental factors that may cause breast cancer. An offshoot of the Sister Study, the Two Sister Study, is designed to look at possible causes of early onset breast cancer. To find out more about these studies, call 1-877-4-SISTER (1-877-474-7837) or visit the Sister Study website ([www.sisterstudy.org](http://www.sisterstudy.org)).

## Chemoprevention

Fenretinide, a retinoid, is also being studied as a way to reduce the risk of breast cancer (retinoids are drugs related to vitamin A). In a small study, this drug reduced breast cancer risk as much as tamoxifen.

Other drugs, such as aromatase inhibitors, are also being studied to reduce the risk of breast cancer.

For more information, see our document *Medicines to Reduce Breast Cancer Risk*.

## Making decisions about DCIS

In some women, DCIS turns into invasive breast cancer and sometimes an area of DCIS contains invasive cancer. In some women, though, the cells may never invade and remain localized within the ducts. If the cells don't invade, DCIS cannot spread to lymph nodes or other organs, and so cannot be life-threatening. The uncertainty about how DCIS will behave makes it difficult for women to make decisions about what treatment to have, if any. Researchers are looking for ways to help with these challenges.

Researchers are studying the use of computers and statistical methods to estimate the odds that a woman's DCIS will become invasive. Some of these methods are based on routinely available clinical information about the patient and her DCIS, whereas others also include information about changes in her tumor's genes. Decision aids are another approach. They ask a woman with DCIS questions that help her decide which factors (such as survival, preventing recurrence, and side effects) she considers most important in choosing a treatment.

Another approach is to look at genes expressed by the DCIS cells using a test such as the Oncotype Dx DCIS Score. This test can be used to predict a woman's chance of DCIS coming back or a new cancer developing in the same breast if she does not get radiation. So far, though, it hasn't been studied well enough to predict how much someone would benefit from radiation after surgery for DCIS.

Another recent area of research and debate among breast cancer specialists is whether changing the name of DCIS to one that emphasizes this is not an invasive cancer can help some women avoid overly aggressive treatment.

## New laboratory tests

### **Circulating tumor cells**

Researchers have found that in many women with breast cancer, cells may break away from the tumor and enter the blood. These circulating tumor cells can be detected with sensitive lab tests. Although these tests can help predict which patients may go on to have their cancer come back, it isn't clear that the use of these tests will help patients live longer. They may potentially be useful for women with advanced breast cancer to help tell if treatments are working.

## Newer imaging tests

Newer imaging methods are now being studied for evaluating abnormalities that may be breast cancers.

### **Scintimammography (molecular breast imaging)**

In scintimammography, a slightly radioactive tracer called *technetium sestamibi* is injected into a vein. The tracer attaches to breast cancer cells and is detected by a special camera.

This technique is still being studied to see if it will be useful in finding breast cancers. Some radiologists believe it may be helpful in looking at suspicious areas found by regular mammograms, but its exact role remains unclear. Current research is aimed at improving the technology and evaluating its use in specific situations such as in the dense breasts of

younger women. Some early studies have suggested that it may be almost as accurate as more expensive magnetic resonance imaging (MRI) scans. This test, however, will not replace your usual screening mammogram.

Several other imaging methods, including thermal imaging (thermography) are discussed in our document *Mammograms and Other Breast Imaging Procedures*.

## Treatment

### Oncoplastic surgery

Breast-conserving surgery (lumpectomy or partial mastectomy) can often be used for early-stage breast cancers. But in some women, it can result in breasts of different sizes and/or shapes. For larger tumors, it might not even be possible, and a mastectomy might be needed instead. Some doctors address this problem by combining cancer surgery and plastic surgery techniques, known as *oncoplastic surgery*. This typically involves reshaping the breast at the time of the initial surgery, and may mean operating on the other breast as well to make them more symmetrical. This approach is still fairly new, and not all doctors are comfortable with it.

### New chemotherapy drugs

Advanced breast cancers are often hard to treat, so researchers are always looking for newer drugs.

A drug class has been developed that targets cancers caused by BRCA mutations. This class of drugs is called *PARP inhibitors* and they have shown promise in clinical trials treating breast, ovarian, and prostate cancers that had spread and were resistant to other treatments. Further studies are being done to see if this drug can help patients without *BRCA* mutations.

### Targeted therapies

Targeted therapies are a group of newer drugs that specifically take advantage of gene changes in cells that cause cancer.

**Drugs that target HER2:** A number of drugs that target HER2 are currently in use, including trastuzumab (Herceptin), pertuzumab (Perjeta), ado-trastuzumab emtansine (Kadcyla), and lapatinib (Tykerb). Other drugs are being developed and tested.

**Anti-angiogenesis drugs:** For cancers to grow, blood vessels must develop to nourish the cancer cells. This process is called *angiogenesis*. Looking at angiogenesis in breast cancer specimens can help predict prognosis. Some studies have found that breast cancers

surrounded by many new, small blood vessels are likely to be more aggressive. More research is needed to confirm this.

Bevacizumab (Avastin) is an example of anti-angiogenesis drug. Although bevacizumab turned out to not be very helpful in the treatment of advanced breast cancer, this approach still may prove useful in breast cancer treatment. Several other anti-angiogenesis drugs are being tested in clinical trials.

**Other targeted drugs:** Everolimus (Afinitor) is a targeted therapy drug that seems to help hormone therapy drugs work better. It is approved to be given with exemestane (Aromasin) to treat advanced hormone receptor-positive breast cancer in post-menopausal women. It has also been studied with other hormone therapy drugs and for treatment of earlier stage breast cancer. In one study, letrozole plus everolimus worked better than letrozole alone in shrinking breast tumors before surgery. It also seemed to help in treating advanced hormone receptor-positive breast cancer when added to tamoxifen. Everolimus is also being studied in combination with chemotherapy and the targeted drug trastuzumab. Other drugs like everolimus are also being studied.

Other potential targets for new breast cancer drugs have been identified in recent years. Drugs based on these targets are now being studied, but most are still in the early stages of clinical trials.

## **Bisphosphonates**

Bisphosphonates are drugs that are used to help strengthen and reduce the risk of fractures in bones that have been weakened by metastatic breast cancer. Examples include pamidronate (Aredia) and zoledronic acid (Zometa).

Some studies have suggested that zoledronic acid may help other systemic therapies, like hormone treatment and chemo work better. In one study of women being treated with chemo before surgery, tumors in the women getting zoledronic acid with chemo shrank more than those in the women treated with chemo alone.

Other studies have looked at the effect of giving zoledronic acid with other adjuvant treatments (like chemo or hormone therapy). So far, the results have been mixed. Some studies have shown that this approach helped lower the risk of the cancer coming back, but others did not. The results of one study linked the use of these drugs with adjuvant chemo with an increased risk of breast cancer recurrence in younger women. Overall, the data does not support making bisphosphonates part of standard therapy for early-stage breast cancer.

## **Denosumab**

Denosumab (Xgeva, Prolia) can also be used to help strengthen and reduce the risk of fractures in bones that have been weakened by metastatic breast cancer. It is being studied to see if it can help adjuvant treatments work better.

## **Vitamin D**

A recent study found that women with early-stage breast cancer who were vitamin D deficient were more likely to have their cancer recur in a distant part of the body and had a poorer outlook. More research is needed to confirm this finding. It is not yet clear if taking vitamin D supplements would be helpful. Still, you might want to talk to your doctor about testing your vitamin D level to see if it is in the healthy range.

# **Additional resources for breast cancer**

## **More information from your American Cancer Society**

Here is more information you might find helpful. You also can order free copies of our documents from our toll-free number, 1-800-227-2345, or read them on our website, [www.cancer.org](http://www.cancer.org).

### **Living with cancer**

After Diagnosis: A Guide for Patients and Families (also available in Spanish)

Distress in People With Cancer

Living With Uncertainty: The Fear of Cancer Recurrence

Clinical Trials: What You Need to Know

Sexuality for the Woman with Cancer (also available in Spanish)

Talking with Your Doctor (also available in Spanish)

Helping Children When a Family Member Has Cancer: Dealing With Diagnosis (also available in Spanish)

Talking With Friends and Relatives About Your Cancer (also in Spanish)

### **Understanding cancer treatments**

Understanding Cancer Surgery: A Guide for Patients and Families (also in Spanish)

Understanding Chemotherapy (also available in Spanish)

Understanding Radiation Therapy (also available in Spanish)

### **Dealing with treatment side effects**

Chemo brain

Fatigue in People With Cancer

Anemia in People With Cancer

Nausea and Vomiting

Exercises After Breast Surgery (also available in Spanish)

Lymphedema: What Every Woman With Breast Cancer Should Know

Where to Find Hair Loss Accessories and Breast Cancer Products

### **Work, insurance, and finances**

Health Insurance and Financial Assistance for the Cancer Patient

Returning to Work After Cancer Treatment

Working During Cancer Treatment

### **More on breasts and breast cancer**

Breast Reconstruction After Mastectomy (also available in Spanish)

Inflammatory Breast Cancer

Breast Cancer Dictionary (also available in Spanish)

Breast Cancer Prevention and Early Detection (also available in Spanish)

Mammograms and Other Breast Imaging Procedures

Non-cancerous Breast Conditions (also available in Spanish)

### **Cancer that doesn't go away, spreads, or comes back after treatment**

When Cancer Doesn't Go Away

When Your Cancer Comes Back: Cancer Recurrence

Bone Metastasis

Nearing the End of Life

Advance Directives

Hospice Care

## **Cancer risk factors and risk reduction**

Genetic Testing: What You Need to Know

Breast Cancer During Pregnancy

DES Exposure: Questions and Answers

Is Abortion Linked to Breast Cancer?

Medicines to Reduce Breast Cancer Risk

Your American Cancer Society also has books that you might find helpful. Call us at 1-800-227-2345 or visit our bookstore online at [cancer.org/bookstore](http://cancer.org/bookstore) to find out about costs or to place an order.

## **National organizations and websites\***

In addition to the American Cancer Society, other sources of patient information and support include:

### **National Cancer Institute**

Toll-free number: 1-800-4-CANCER (1-800-422-6237)

Website: [www.cancer.gov](http://www.cancer.gov)

Offers current information about breast cancer screening, diagnosis, and treatment as well as information on other types of cancer, as well as information for the family and children of people with cancer

### **Susan G. Komen for the Cure**

Toll-free number: 1-877-465-6636

Website: [www.komen.org](http://www.komen.org)

Offers information on breast health and breast cancer; tools, including videos and quizzes; and referrals to support groups. Some written materials in Spanish, Arabic, Chinese, Vietnamese, Russian, and Korean

### **Centers for Disease Control and Prevention (CDC)**

Toll-free number: 1-800-232-4636 (1-800-CDC INFO)

Website: [www.cdc.gov](http://www.cdc.gov)

To find out more about the National Breast and Cervical Cancer Early Detection Program (NBCCEDP), which provides breast and cervical cancer early detection testing to women without health insurance for free or at very little cost

*\*Inclusion on this list does not imply endorsement by the American Cancer Society.*

No matter who you are, we can help. Contact us anytime, day or night, for information and support. Call us at **1-800-227-2345** or visit [www.cancer.org](http://www.cancer.org)

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