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About Breast Cancer

Breast Cancer Basics

Get an overview of what breast cancer is, how it forms, and how common it is.

- [What Is Breast Cancer?](#)
- [How Does Breast Cancer Start?](#)
- [How Common Is Breast Cancer?](#)
- [What's New in Breast Cancer Research?](#)

Signs and Symptoms of Breast Cancer

The most common symptom of breast cancer is a new lump or mass, but other symptoms are also possible. It's important to have any breast change checked by a health care provider.

- [Breast Cancer Signs and Symptoms](#)

What Is Breast Cancer?

Breast cancer is a type of cancer that starts in the breast. Cancer starts when cells begin to grow out of control. (To learn more about how cancers start and spread, see [What Is Cancer?](#)¹)

Breast cancer cells usually form a tumor that can often be seen on an x-ray or felt as a

lump. Breast cancer occurs almost entirely in women, but [men can get breast cancer](#)², too.

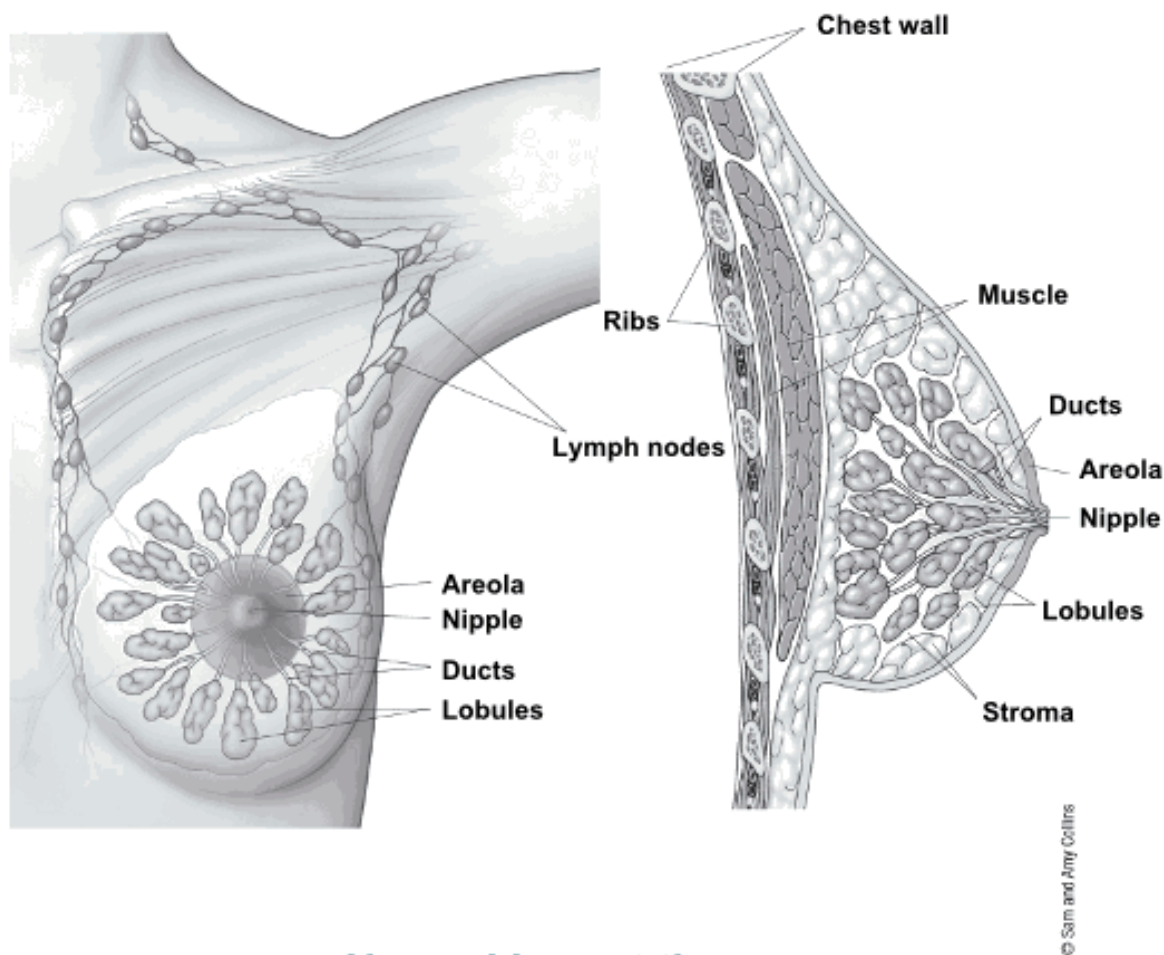
It's important to understand that most breast lumps are benign and not cancer (malignant). Non-cancerous breast tumors are abnormal growths, but they do not spread outside of the breast. They are not life threatening, but some types of benign breast lumps can increase a woman's risk of getting breast cancer. Any breast lump or change needs to be checked by a health care professional to determine if it is benign or malignant (cancer) and if it might affect your future cancer risk. See [Non-cancerous Breast Conditions](#)³ to learn more.

Where breast cancer starts

Breast cancers can start from different parts of the breast.

- Most breast cancers begin in the ducts that carry milk to the nipple (ductal cancers)
- Some start in the glands that make breast milk (lobular cancers)
- There are also other types of breast cancer that are less common like phyllodes tumor and angiosarcoma
- A small number of cancers start in other tissues in the breast. These cancers are called [sarcomas](#)⁴ and [lymphomas](#)⁵ and are not really thought of as breast cancers.

Although many types of breast cancer can cause a lump in the breast, not all do. See [Breast Cancer Signs and Symptoms](#) to learn what you should watch for and report to a health care provider. Many breast cancers are also found on screening mammograms, which can detect cancers at an earlier stage, often before they can be felt, and before symptoms develop.



Normal breast tissue

Types of breast cancer

There are many different types of breast cancer and common ones include ductal carcinoma in situ (DCIS) and invasive carcinoma. Others, like phyllodes tumors and angiosarcoma are less common.

Once a biopsy is done, breast cancer cells are tested for proteins called estrogen receptors, progesterone receptors and HER2. The tumor cells are also closely looked at in the lab to find out what grade it is. The specific proteins found and the tumor grade can help decide treatment options.

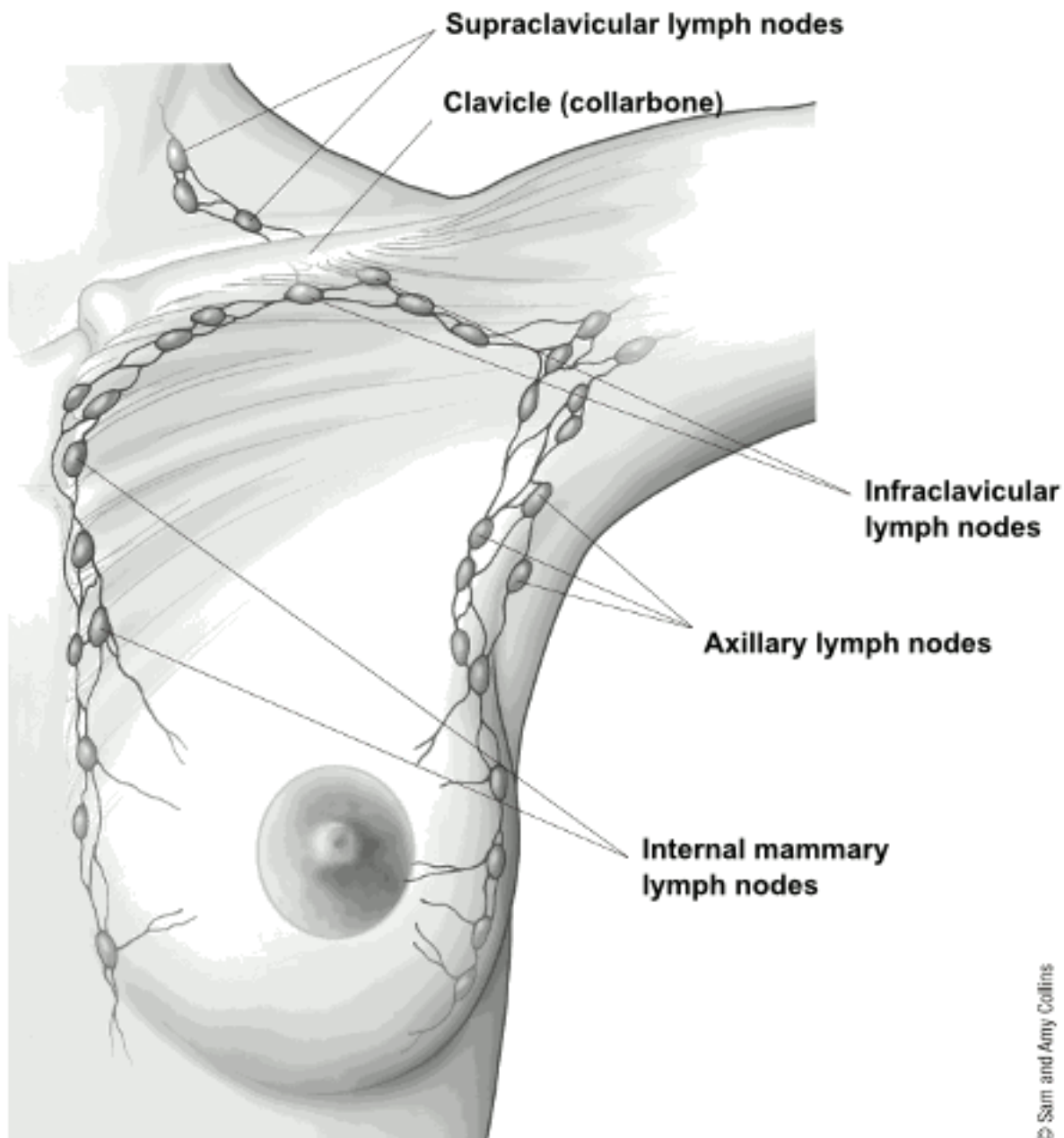
To learn more about specific types of breast cancer and tests done on the breast cancer cells, see [Understanding a Breast Cancer Diagnosis](#)⁶.

How breast cancer spreads

Breast cancer can spread when the cancer cells get into the blood or lymph system and are carried to other parts of the body.

The lymph system is a network of lymph (or lymphatic) vessels found throughout the body that connects lymph nodes (small bean-shaped collections of immune system cells). The clear fluid inside the lymph vessels, called lymph, contains tissue by-products and waste material, as well as immune system cells. The lymph vessels carry lymph fluid away from the breast. In the case of breast cancer, cancer cells can enter those lymph vessels and start to grow in lymph nodes. Most of the lymph vessels of the breast drain into:

- Lymph nodes under the arm (axillary nodes)
- Lymph nodes around the collar bone (supraclavicular [above the collar bone] and infraclavicular [below the collar bone] lymph nodes)
- Lymph nodes inside the chest near the breast bone (internal mammary lymph nodes)



Lymph nodes in relation to the breast

If cancer cells have spread to your lymph nodes, there is a higher chance that the cells could have traveled through the lymph system and spread (metastasized) to other parts of your body. The more lymph nodes with breast cancer cells, the more likely it is that the cancer may be found in other organs. Because of this, finding cancer in one or more

lymph nodes often affects your treatment plan. Usually, you will need surgery to remove one or more lymph nodes to know whether the cancer has spread.

Still, not all women with cancer cells in their lymph nodes develop metastases, and some women with no cancer cells in their lymph nodes develop metastases later.

Hyperlinks

1. www.cancer.org/cancer/cancer-basics/what-is-cancer.html
2. www.cancer.org/cancer/breast-cancer-in-men.html
3. www.cancer.org/cancer/breast-cancer/non-cancerous-breast-conditions.html
4. www.cancer.org/cancer/soft-tissue-sarcoma.html
5. www.cancer.org/cancer/lymphoma.html
6. www.cancer.org/cancer/breast-cancer/understanding-a-breast-cancer-diagnosis.html

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How Does Breast Cancer Start?

Changes or mutations in DNA can cause normal breast cells to become cancer. Certain DNA changes are passed on from parents (inherited) and can greatly increase your [risk for breast cancer](#)¹. Other lifestyle-related risk factors, such as what you eat and how much you exercise, can increase your chance of developing breast cancer, but it's not yet known exactly how some of these risk factors cause normal cells to become cancer. Hormones seem to play a role in many cases of breast cancer, but just how this happens is not fully understood.

Inherited versus acquired DNA mutations

Normal breast cells become cancer because of changes (mutations) in DNA. DNA is the chemical in our cells that makes up our [genes](#)². Genes have the instructions for how our cells function.

Some DNA mutations are *inherited* or passed to you from your parents. This means the mutations are in all your cells when you are born. Some mutations can greatly increase the risk of certain cancers. They cause many of the cancers that run in some families and often cause cancer when people are younger.

But most DNA mutations linked to breast cancer are *acquired*. This means the change takes place in breast cells during a person's life rather than having been inherited or born with them. Acquired DNA mutations take place over time and are only in the breast cancer cells.

Mutated DNA can lead to mutated genes. Some genes control when our cells grow, divide into new cells, and die. Changes in these genes can cause the cells to lose normal control and are linked to cancer.

Proto-oncogenes

Proto-oncogenes are genes that help cells grow normally. When a proto-oncogene mutates (changes) or there are too many copies of it, it becomes a "bad" gene that can stay turned on or activated when it's not supposed to be. When this happens, the cell grows out of control and makes more cells that grow out of control. This can lead to cancer. This bad gene is called an [oncogene](#)³.

Think of a cell as a car. For the car to work properly, there need to be ways to control how fast it goes. A proto-oncogene normally functions in a way that's much like a gas pedal. It helps control how and when the cell grows and divides. An oncogene is like a gas pedal that's stuck down, which causes the cell to divide out of control.

Tumor suppression genes

[Tumor suppressor genes](#)⁴ are normal genes that slow down cell division (cell growth), repair DNA mistakes, or tell cells when to die (a process known as *apoptosis* or *programmed cell death*). When tumor suppressor genes don't work properly, cells can grow out of control, make more cells that grow out of control, and cells don't die when they should, which can lead to cancer.

A tumor suppressor gene is like the brake pedal on a car. It normally keeps the cell from dividing too quickly, just as a brake keeps a car from going too fast. When something goes wrong with the gene, such as a mutation, the “brakes” don't work and cell division can get out of control.

Inherited gene changes

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

Women have already begun to benefit from advances in understanding the genetic basis of breast cancer. [Genetic testing](#)⁵ can identify some women who have inherited mutations in the BRCA1 or BRCA2 tumor suppressor genes (or less commonly in other genes such as PALB2, ATM or CHEK2). These women can then take steps to reduce their risk of breast cancer by increasing awareness of their breasts and following appropriate [screening recommendations](#)⁶ to help find cancer at an earlier, more treatable stage. Since these mutations in BRCA1 and BRCA2 genes are also associated with other cancers (besides breast), women with these mutations might also consider early screening and preventive actions for other cancers.

Mutations in tumor suppressor genes like the BRCA genes are considered “high penetrance” because they often lead to cancer. And although many 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 effect on cancer occurring in any one person, but the overall effect on the population can be large because the mutations are common, and people often have more than one at the same time. The genes involved

can affect things like hormone levels, metabolism, or other factors that impact risk for breast cancer. These genes might also cause much of the risk of breast cancer that runs in families.

Acquired gene changes

Most DNA mutations related to breast cancer take place in 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.

Hyperlinks

1. www.cancer.org/cancer/breast-cancer/risk-and-prevention.html
2. www.cancer.org/cancer/cancer-causes/genetics/genes-and-cancer/what-are-genes.html
3. www.cancer.org/cancer/cancer-causes/genetics/genes-and-cancer/oncogenes-tumor-suppressor-genes.html
4. www.cancer.org/cancer/cancer-causes/genetics/genes-and-cancer/oncogenes-tumor-suppressor-genes.html
5. www.cancer.org/cancer/cancer-causes/genetics.html
6. www.cancer.org/cancer/breast-cancer/screening-tests-and-early-detection/american-cancer-society-recommendations-for-the-early-detection-of-breast-cancer.html

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How Common Is Breast Cancer?

Breast cancer is the most common cancer in American women, except for skin cancers. Currently, the average risk of a woman in the United States developing breast cancer sometime in her life is about 13%. This means there is a 1 in 8 chance she will develop breast cancer. This also means there is a 7 in 8 chance she will never have the disease.

Current year estimates for breast cancer

The American Cancer Society's estimates for breast cancer in the United States for 2020 are:

- About 276,480 new cases of invasive breast cancer will be diagnosed in women.
- About 48,530 new cases of carcinoma in situ (CIS) will be diagnosed (CIS is non-invasive and is the earliest form of breast cancer).
- About 42,170 women will die from breast cancer.

Trends in breast cancer incidence

In recent years, incidence rates have increased slightly (by 0.3% per year).

Trends in breast cancer deaths

Breast cancer is the second leading cause of cancer death in women (only lung cancer kills more women each year). The chance that a woman will die from breast cancer is about 1 in 38 (about 2.6%).

Since 2007, breast cancer death rates have been steady in women younger than 50, but have continued to decrease in older women. From 2013 to 2017, the death rate decreased by 1.3% per year.

These decreases are believed to be the result of finding breast cancer earlier through screening and increased awareness, as well as better treatments.

Breast cancer survivors

At this time there are more than 3.5 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 [Survival Rates for Breast Cancer](#)¹.

Visit the [American Cancer Society's Cancer Statistics Center](#)² for more key statistics.

Hyperlinks

1. www.cancer.org/cancer/breast-cancer/understanding-a-breast-cancer-diagnosis/breast-cancer-survival-rates.html
2. <https://cancerstatisticscenter.cancer.org/#/>

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Breast Cancer Signs and Symptoms

Knowing how your breasts normally look and feel is an important part of breast health. Although having regular screening tests for breast cancer is important, mammograms do not find every breast cancer. This means it's also important for you to be aware of changes in your breasts and to know the signs and symptoms of 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 cancer, but breast cancers can be tender, soft, or round. They can even be painful. For this reason, it's important to

have any new breast mass, lump, or breast change checked by an experienced health care professional.

Other possible symptoms of breast cancer include:

- Swelling of all or part of a breast (even if no lump is felt)
- Skin dimpling (sometimes looking like an orange peel)
- Breast or nipple pain
- Nipple retraction (turning inward)
- Nipple or breast skin that is red, dry, flaking or thickened
- Nipple discharge (other than breast milk)
- Swollen lymph nodes (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 is large enough to be felt.)

Although any of these symptoms can be caused by things other than breast cancer, if you have them, they should be reported to a health care professional so the cause can be found.

Remember that knowing what to look for does not take the place of having regular [mammograms](#)¹ and other [screening tests](#)². Screening tests can help find breast cancer early, before any symptoms appear. Finding breast cancer early gives you a better chance of successful treatment.

Hyperlinks

1. www.cancer.org/cancer/breast-cancer/screening-tests-and-early-detection/mammograms.html
2. www.cancer.org/cancer/breast-cancer/screening-tests-and-early-detection.html

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What's New in Breast Cancer Research?

Researchers around the world are working to find better ways to prevent, detect, and treat breast cancer, and to improve the quality of life of patients and survivors.

Breast cancer causes

Studies continue to uncover lifestyle factors and habits, as well as inherited genes, that affect breast cancer risk. Here are a few examples:

- Several studies are looking at the effect of exercise, weight gain or loss, and diet on risk.
- Studies on the best use of genetic testing for breast cancer mutations continue.
- Scientists are exploring how common gene variations (small changes in genes that are not as significant as mutations) may affect breast cancer risk. Gene variants typically have only a modest effect on risk, but when taken together they could possibly have a large impact.
- Possible environmental causes of breast cancer 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.

Reducing breast cancer risk

Researchers continue to look for medicines that might help lower breast cancer risk, especially women who are at high risk.

- Estrogen blocking drugs are typically used to help treat breast cancer, but some might also help prevent it. Tamoxifen and raloxifene have been used for many

years to prevent breast cancer. More recent studies with another class of drugs called aromatase inhibitors (exemestane and anastrozole) have shown that these drugs are also very effective in preventing breast cancer

- Other clinical trials are looking at non-hormonal drugs for breast cancer reduction. Drugs of interest include drugs for diabetes like metformin, drugs used to treat blood or bone marrow disorders, like ruxolitinib, and bexarotene, a drug that treats a specific type of T-cell lymphoma.

This type of research takes many years. It might be some time before meaningful results on any of these compounds are available.

New lab tests

Liquid biopsies

Circulating tumor cells (CTCs) and circulating tumor DNA (ctDNA)

Circulating tumor cells (CTCs) are cancer cells that break away from the tumor and move into the bloodstream. Circulating tumor DNA (ctDNA) is DNA that is released into the bloodstream when cancer cells die. Researchers are investigating tests that measure the amount of CTCs and ctDNA in the blood of women with breast cancer. Identifying and testing the CTCs and ctDNA in the blood is sometimes referred to as a “liquid biopsy.” This type of biopsy may offer an easier and less expensive way to test the tumor than a traditional needle biopsy, which comes with risks such as bleeding and infection.

Some studies have shown that in women with metastatic (Stage 4) breast cancer, a high level of CTCs might predict a poorer outcome compared to women with a lower level.

Although more studies are needed before liquid biopsies could replace the traditional needle biopsy, some potential uses include:

- Looking for new gene changes (mutations) in the tumor cells that might mean the cancer has become resistant to specific treatments (like aromatase inhibitors)
- Determining if a certain drug will work on a tumor before trying it
- Helping decide if a woman’s cancer is responding to a certain treatment by noticing a decline in CTC level
- Predicting if the breast cancer will recur (come back) in women with early stage

breast cancer

New imaging tests

Newer types of tests are being developed for breast imaging. Some of these are already being used in certain situations, while others are still being studied. It will take time to see if they are as good as or better than those used today. Some of these tests include:

- Scintimammography (molecular breast imaging)
- Positron emission mammography (PEM)
- Electrical impedance imaging (EIT)
- Elastography
- New types of optical imaging tests

For more on these tests, see [Newer and Experimental Breast Imaging Tests.](#)¹

Breast cancer treatment

Chemotherapy

It is known that [chemotherapy](#)² can be helpful for many breast cancer patients. But predicting who will benefit the most or the least is still being studied. Sometimes there are significant side effects (long- and short-term) from chemotherapy, so having tests that can determine who really needs chemo would be useful. Many studies are being done to evaluate different tests that can more accurately tell which patients would benefit from chemo and which patients could avoid it.

Triple-negative breast cancer

Since triple-negative breast cancers (TNBC) cannot be treated with hormone therapy or targeted therapy such as HER2 drugs, the treatment options are limited to chemotherapy. And although TNBC tends to respond well to initial chemotherapy, it tends to come back (recur) more frequently than other breast cancers.

In 2019, the immunotherapy drug Atezolizumab (Tecentriq), was approved along with the chemotherapy drug nab-paclitaxel (Abraxane) for use in women with advanced triple negative breast cancer that makes the PD-L1 protein. Other potential targets for new breast cancer drugs have been identified in recent years. Drugs based on these targets,

such as kinase inhibitors, are now being studied to treat triple-negative breast cancers, either by themselves, or in combination with chemotherapy. One example is the AKT inhibitor ipatasertib, which, when used with paclitaxel, shows promising results in treating women with TNBC as the first treatment. Another AKT inhibitor, capivasertib, is also showing encouraging results when given with paclitaxel.

Androgen receptor inhibitors

Breast cancer cells are routinely tested for estrogen and progesterone receptors to help determine treatment options. About 60% of breast cancer cells also have receptors for androgens (male hormones). Initial studies in women with breast cancer show some response when using the antiandrogen bicalutamide, to treat TNBC that has the androgen receptor. Bicalutamide is a drug that has been used to treat prostate cancer for many years. More studies in breast cancer are ongoing.

Supportive care

There are trials looking at different medicines to try and improve memory and [brain symptoms after chemotherapy](#)³. Other studies are evaluating if certain cardiac drugs, known as beta-blockers, can prevent the heart damage sometimes caused by common breast cancer drugs such as doxorubicin and trastuzumab.

Thinking about taking part in a clinical trial

Clinical trials are carefully controlled research studies that are done to get a closer look at promising new treatments or procedures. Clinical trials are one way to get state-of-the-art cancer treatment. In some cases, they may be the only way to get access to newer treatments. They are also the best way for doctors to learn better methods to treat cancer. Still, they are not right for everyone.

If you would like to learn more about clinical trials that might be right for you, start by asking your doctor if your clinic or hospital conducts clinical trials, or see [Clinical Trials](#)⁴ to learn more.

Hyperlinks

1. www.cancer.org/cancer/breast-cancer/screening-tests-and-early-detection/experimental-breast-imaging.html
2. www.cancer.org/cancer/breast-cancer/treatment/chemotherapy-for-breast-cancer.html

3. www.cancer.org/treatment/treatments-and-side-effects/physical-side-effects/changes-in-mood-or-thinking/chemo-brain.html
4. www.cancer.org/treatment/treatments-and-side-effects/clinical-trials.html

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