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For patients

Breast Cancer



Breast cancer is a malignant tumor in or around breast tissue. It usually begins as a lump or calcium deposit that develops from abnormal cell growth. Most breast lumps are benign, but some can be pre-cancerous or cancerous. Breast cancer can be localized (initially appearing within the breast) or metastatic (spread to another part of the body).

Your doctor will likely perform a physical exam to evaluate a breast lump. To determine whether that lump is benign, your doctor may order mammography, breast ultrasound, breast MRI, PET/CT or scintimammography. If the lump is indeed benign, no further action may be needed. However, your doctor may want to monitor it to see if it changes, grows, or disappears over time. If the tests are inconclusive, your doctor may perform a biopsy using ultrasound, x-ray, or magnetic resonance imaging guidance. Breast cancer treatment depends on the tumor's size, extent of disease spread, type, receptor status, tumor growth rate and the patient's general health. Treatments include surgery, radiation therapy, chemotherapy, hormone therapy or a combination thereof.

What is breast cancer?

Breast cancer is a malignant (http://www.radiologyinfo.org) tumor that grows in or around the breast tissue, mainly in the milk ducts and glands. A tumor usually starts as a lump or calcium deposit that develops as a result of abnormal cell growth. Most breast lumps (https://www.radiologyinfo.org/en/info/breastlumps) are benign (http://www.radiologyinfo.org) but some can be premalignant (may become cancer) or malignant.

Breast cancer is classified as either primary (http://www.radiologyinfo.org) or metastatic (http://www.radiologyinfo.org) . The initial malignant tumor that develops within the breast tissue is known as primary breast cancer. Sometimes, primary breast cancer can also be found when it is spread to lymph nodes that are close by in the armpit. Metastatic breast cancer, or advanced cancer, is formed when cancer cells located in the breast break away and travel to another organ or part of the body.

The cause of breast cancer is still unknown. However, some risk factors include:

- Age
- Gender
- Race
- Family history and genetic factors
- History of previous cancers (such a colon or ovarian cancer)
- Dense breast (https://www.radiologyinfo.org/en/info/dense-breasts) (meaning there is a lot of ducts, glands, fibrous tissue and less fatty tissue)
- Body Mass Index
- Use of hormone replacement therapies
- Alcohol use
- Age of first period, number of viable pregnancies, and age of first childbirth

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Risk factors are not a sure indication that you will develop breast cancer. Some women with breast cancer have no risk factors. On the other hand, many women with risk factors never develop the disease.

Breast cancer symptoms may not appear in the early stages of the disease. However, as the cancer develops, symptoms may include:

- A lump or thickening in or near the breast or underarm
- Pain or tenderness in the breast or nipple
- Clear or bloody nipple discharge
- Change in the breast or nipple such as color, shape or size
- Swelling in the armpit
- Redness or flakiness around the nipple or skin of the breast

How is breast cancer diagnosed and evaluated?

Your primary doctor will begin by asking you about your medical history, risk factors and symptoms. You will also undergo a physical exam.

In order to determine if a breast lump is malignant or benign, one or more of the following imaging tests may be performed:

- Mammogram (https://www.radiologyinfo.org/en/info/mammo) : Mammography is a type of x-ray examination used to examine the breasts. This type of imaging involves exposing the breasts to a small amount of ionizing radiation to obtain pictures of the inside of the breasts. *See the Safety page (https://www.radiologyinfo.org/en/info/safety-xray) for more information about x-rays.*
- Breast ultrasound (https://www.radiologyinfo.org/en/info/breastus) : Breast ultrasound uses sound waves to create pictures of the inside of the breasts. Breast ultrasound can capture images of areas of the breast that may be difficult to see with mammography. It can also help to determine whether a breast lump is a solid mass or a cyst.
- *Breast MRI: (https://www.radiologyinfo.org/en/info/breastmr)* During breast MRI, a powerful magnetic field, radio frequency pulses and a computer will be used to produce detailed pictures of the inside of the breasts. MRI is helpful in evaluating breast lumps that are not visible with mammography or ultrasound, particularly in women with dense breast tissue.
- PET/CT (https://www.radiologyinfo.org/en/info/pet) : This type of nuclear imaging combines PET scans and CT scans to provide images that pinpoint the anatomic location of abnormal metabolic activity within the breasts. It can detect breast cancer, determine if it has spread, assess the effectiveness of a treatment plan and determine if the cancer has returned after treatment.
- Scintimammography (https://www.radiologyinfo.org/en/info/scintimammo) : This imaging test, also known as nuclear medicine breast imaging, may be used to investigate a breast abnormality that has been discovered on mammography. The procedure is noninvasive (http://www.radiologyinfo.org) and involves the injection of a radiotracer (http://www.radiologyinfo.org) , or drug that emits radioactivity, into the patient. Because the radiotracer accumulates differently in different kinds of tissue, it can help physicians determine whether cancer could be present, thus helping determine whether a biopsy or additional follow-up is necessary. While it is not a primary screening tool and does not replace mammography, some physicians have used it as an additional tool in women who are at elevated risk for breast cancer, but cannot undergo MRI screening.

If a lump is proven to be benign by these exams, no further steps may be needed. Your doctor may want to monitor the area at future visits to check if the breast lump has changed, grown or gone away.

If these tests do not clearly show that the lump is benign, a biopsy (http://www.radiologyinfo.org) may be necessary. If so, one of the following image-guided procedures may be performed:

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- Ultrasound-guided biopsy (https://www.radiologyinfo.org/en/info/breastbius) : During this type of biopsy, ultrasound imaging is used to visualize a breast lump. An interventional radiologist will advance a thin needle to the site of the lump using the real-time ultrasound images and remove some tissue for evaluation under a microscope. The biopsy procedure is usually quick, but it may take a few days before the final tissue analysis (pathology report) is ready.
- Stereotactic (x-ray guided) biopsy (https://www.radiologyinfo.org/en/info/breastbixr) : During this type of biopsy, a digital mammography x-ray machine is used to produce real-time pictures of the breast. A radiologist uses these live pictures to guide placement of a needle to the site of the lump and remove tissue samples for further evaluation.
- MRI-guided biopsy (https://www.radiologyinfo.org/en/info/breastbimr) : An MRI machine is used to produce pictures of the breasts and help the radiologist guide a needle to the site of the lump to remove a tissue sample.

How is a breast cancer treated?

The type of treatment recommended depends on the size and type of the tumor, its growth rate, and the general health of the patient. Treatment options include:

- Surgery: Surgery can consist of mastectomy or breast conservation therapy (BCT).
  - Mastectomy is an operation to remove the entire breast, and usually the entire nipple. Often an axillary (armpit) sampling is also done which removes the glands under the arm called axillary nodes. The surgeon may evaluate just one or two nodes (sentinel node/s) or may perform a more extensive axillary dissection to check for disease spread. Mastectomy sometimes requires a hospital stay. A drainage tube is sometimes temporarily left in the surgical cavity after a mastectomy to help prevent fluid accumulation. Women who undergo a mastectomy have the option of breast reconstruction.
  - BCT surgery (such as lumpectomy, partial mastectomy, segmental mastectomy or quadrantectomy) removes the breast tumor and a margin of surrounding normal tissues. Radiation therapy (http://www.radiologyinfo.org) usually follows lumpectomy to eliminate any microscopic cancer cells in the remaining breast tissue. The purpose of BCT is to give women the same cure rate they would have if they were treated with a mastectomy but to leave the breast intact, with an appearance and texture as close as possible to what they had before treatment. The surgeon may remove some lymph nodes by performing a sentinel lymph node procedure or axillary dissection at the same time as the lumpectomy procedure or later.
- Radiation therapy (https://www.radiologyinfo.org/en/info/intro_onco) *:* Radiation therapy uses high-energy x-rays (photons) or a stream of particles. When radiation is used at therapeutic doses (many times those used for x-ray imaging exams) it can destroy abnormal cancer cells in the breasts. Your radiation therapy procedure might include:
  - External Beam Therapy (EBT) (https://www.radiologyinfo.org/en/info/ebt) : EBT, also called external radiation therapy, delivers one or more beams of high-energy x-rays to a tumor in the breast. Beams are generated outside the patient (usually by a linear accelerator) and are targeted at the tumor site. These high energy x-rays can deliver their dose to the area of the tumor to destroy the cancer cells and, with careful treatment planning, spare the surrounding normal tissues. No radioactive sources are placed inside the patient's body.
    LINAC (https://www.radiologyinfo.org/en/info/linac) page for more information about linear accelerator.
  - Intensity-Modulated Radiation Therapy (IMRT) (https://www.radiologyinfo.org/en/info/imrt) : IMRT is an advanced mode of high-precision radiotherapy that uses computer-controlled linear accelerators to deliver precise radiation doses to a malignant tumor or specific areas within the tumor. IMRT allows for the radiation dose to conform more precisely to the three-dimensional (3-D) shape of the tumor by modulating—or controlling—the intensity of the radiation beam in multiple small volumes. IMRT also allows higher radiation doses to be focused on regions within the tumor while minimizing the dose to surrounding normal critical structures. Treatment is carefully planned by using 3-D computed tomography (CT) or magnetic resonance (MRI) images of the patient in conjunction with computerized dose calculations to determine the dose intensity pattern that will best conform to the tumor shape. Typically, combinations of multiple intensity-modulated fields coming from different beam directions produce a custom tailored radiation dose that maximizes tumor dose while also minimizing the dose to adjacent normal tissues.
  - *Brachytherapy: (https://www.radiologyinfo.org/en/info/brachy)* Brachytherapy, also called internal radiation therapy, allows a physician to use a higher total dose of radiation to treat a smaller area and in a shorter time. In breast cancer, brachytherapy is used as radiation therapy to treat the partial breast only. It may be either temporary or permanent,

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although temporary brachytherapy (http://www.radiologyinfo.org) is the most commonly used form of brachytherapy in breast cancer. Accelerated partial breast irradiation with temporary brachytherapy places a highly radioactive material inside a device with one or more catheters (slender tubes) in or near a tumor for a specific amount of time and then withdraws it. Temporary brachytherapy is administered at a high-dose rate (HDR) (http://www.radiologyinfo.org) for five days twice daily. This is a form of partial breast radiation therapy.

- Intraoperative Radiation Therapy (IORT): IORT is a type of radiation therapy that is delivered during the time of surgery while the tumor cavity is exposed. Select women with early breast cancer may be offered IORT. High doses of radiation therapy are delivered to the surgical bed only. This is a form of partial breast radiation.

There are certainly advantages and disadvantages with each type of radiation therapy that should be discussed with the radiation oncologist.

- Chemotherapy (http://www.radiologyinfo.org) : Patients may also undergo chemotherapy if there is a risk that the cancer may have spread outside of the breast to other body organs. Chemotherapy drugs may be taken by pill or by injection and are sometimes used in combination with radiation therapy. In some cases, breast cancer will be treated with chemotherapy before it has been removed by surgery. This is called neoadjuvant chemotherapy. When chemotherapy is used after surgery, it is called adjuvant.
  Sometimes, the tumor may be subjected to genomic testing to help determine how the cancer may behave and to analyze a series of genes in the tumor. This information can help patients make a more informed decision about whether or not they should undergo chemotherapy.
- Hormone Therapy: Hormone therapy is sometimes offered for patients with ER (estrogen) or PR + (progesterone) disease. Tamoxifen is usually offered for premenopausal women. For postmenopausal women, sometimes, an aromatase inhibitor is offered as a hormone blockade.
- Targeted Cancer Therapy: Targeted cancer treatments are drugs that are sometimes used in tumors that have genetic changes that make them different from normal cells. Targeted drugs specifically attack cancer cells that have these genetic changes. They may be offered in combination with chemotherapy.
- A combination of any of these treatment options may be performed.

See the Breast Cancer Treatment (https://www.radiologyinfo.org/en/info/breast-cancer-therapy) page for more information.

Which test, procedure or treatment is best for me?

- *Breast Cancer Screening (https://www.radiologyinfo.org/en/info/acs-breast-cancer-screening)*
- *Breast Imaging of Pregnant and Lactating Women (https://www.radiologyinfo.org/en/info/acs-breast-imaging-pregnant-lactating)*
- *Breast Implant Evaluation (https://www.radiologyinfo.org/en/info/acs-breast-implant-evaluation)*
- *Breast pain (https://www.radiologyinfo.org/en/info/acs-breast-pain)*
- *Evaluation of Nipple Discharge (https://www.radiologyinfo.org/en/info/acs-eval-nipple-discharge)*
- *Imaging of Deep Inferior Epigastric Arteries for Surgical Planning (Breast Reconstruction Surgery) (https://www.radiologyinfo.org/en/info/acs-imaging-deep-inferior-epigastric-arteries)*
- *Monitoring Response to Neoadjuvant Systemic Therapy for Breast Cancer (https://www.radiologyinfo.org/en/info/acs-neoadjuvant-systemic-therapy-breast-cancer)*
- *Palpable Breast Masses (https://www.radiologyinfo.org/en/info/acs-palpable-breast-masses)*
- *Supplemental Breast Cancer Screening Based on Breast Density (https://www.radiologyinfo.org/en/info/acs-bc-screening-breast-density-based)*
- *Transgender Breast Cancer Screening (https://www.radiologyinfo.org/en/info/acs-bc-screening-transgender)*

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