Mammograms and Other Breast Imaging Procedures

What is a mammogram?

A mammogram is an x-ray exam of the breast that’s used to detect and evaluate breast changes.

X-rays were first used to examine breast tissue nearly a century ago, by the German surgeon, Albert Salomon. But modern mammography has only existed since the late 1960s, when special x-ray machines were designed and used just for breast imaging. Since then, the technology has advanced a lot, and today’s mammogram is very different even from those of the 1980s and 1990s.

Today, the x-ray machines used for mammograms produce lower energy x-rays. These x-rays do not go through tissue as easily as those used for routine chest x-rays or x-rays of the arms or legs, and this improves the image quality. Mammograms today expose the breast to much less radiation compared with those in the past.

Types of mammograms

Screening mammograms look for signs of cancer

Screening mammogram are x-ray exams of the breasts that are used for women who have no breast symptoms. The goal of a screening mammogram is to find breast cancer when it’s too small to be felt by a woman or her doctor. Finding small breast cancers early (before they have grown and spread) with a screening mammogram greatly improves a woman’s chance for successful treatment.

A screening mammogram usually takes 2 x-ray pictures (views) of each breast. Some women, such as those with large breasts, may need to have more pictures to see as much breast tissue as possible.
Diagnostic mammograms investigate possible problems

A woman with a breast problem (for instance, a lump or nipple discharge) or an abnormal area found in a screening mammogram typically gets a diagnostic mammogram. It’s still an x-ray exam of the breast, but it’s done for a different purpose.

During a diagnostic mammogram, additional pictures are taken to carefully study the area of concern. In most cases, special pictures are enlarged to make a small area of suspicious breast tissue bigger and easier to evaluate. Other types of x-ray pictures can be done, too, depending on the type of problem and where it is in the breast.

A diagnostic mammogram may offer a closer look and show that an area that looked abnormal on a screening mammogram is actually normal. When this happens, the woman goes back to routine yearly screening.

A diagnostic mammogram could also show that an area of abnormal tissue probably is not cancer, but the radiologist may not be ready to say that the area is normal based on these pictures alone. When this happens it’s common to ask the woman to return to be re-checked, usually in 4 to 6 months.

The results of the diagnostic work-up may suggest that a biopsy is needed to find out if the abnormal area is cancer. If your doctor recommends a biopsy, it does not mean that you have cancer. About 80% of all breast changes that are biopsied are found to be benign (not cancer). If a biopsy is needed, you should discuss the different types of biopsy with your doctor to decide which type is best for you.

How is a mammogram done?

When you have a mammogram, your breast is briefly compressed or squeezed between 2 plates attached to the mammogram machine—an adjustable plastic plate (on top) and a fixed x-ray plate (on the bottom). The bottom plate holds the x-ray film, or the digital detector that makes the image. The technologist compresses your breast to keep it from moving, and to make the layer of breast tissue thinner. These steps reduce the x-ray exposure and make the picture sharper. Although the compression can feel uncomfortable and even painful for some women, it only lasts a few seconds and is needed to get a good picture. Talk to the technologist if you have pain. She can reposition you to make the pressure as comfortable as possible. The entire procedure for a mammogram takes about 20 minutes.
Mammograms produce a black and white x-ray picture of the breast tissue. Depending on the type of machine, the picture is either on a large sheet of film or is an electronic image that can be seen on a computer screen. These two ways of doing a mammogram are much the same. The differences are in the way the picture is recorded, looked at by the doctor, and stored.

*Screen-film units* are the machines that produce the mammogram picture on x-ray film. *Full-field digital mammography units* capture the picture in a digital format that can be looked at on a computer screen. Most mammogram machines in use today are full-field digital units.

For the most part, regular screen-film mammograms are as accurate as digital mammograms. But digital mammograms have been shown to have some unique advantages. Some studies have found that women who have questionable areas on their mammogram have to return less often for extra imaging tests because with digital mammograms, the original pictures can be magnified and looked at in many different ways on the computer screen. Several studies have also found that digital mammograms were more accurate in finding cancers in women younger than 50 and in women with dense breast tissue.

It’s important to remember that standard film mammograms also work well for these groups of women, and that women should still get their regular mammograms, even if digital mammography is not available.

No matter what kind of x-ray image is taken – film or electronic – it’s interpreted (or “read”) by a doctor, most often a radiologist. *Radiologists* are doctors who have special training in diagnosing diseases by looking at pictures of the inside of the body produced by x-rays, sound waves, magnetic fields, or other methods. Other doctors who treat breast diseases may look at the mammogram, too.
Reading mammograms is challenging. The way the breast looks on a mammogram varies a great deal from woman to woman. And some breast cancers may cause changes in the mammogram that are hard to notice.

If you have had mammograms in the past, it’s very important that the radiologist has your most recent x-ray films or digital pictures so they can be compared with the new ones. (The actual pictures are needed, not just the report.) Comparing the pictures helps the doctor find small changes and detect cancer as early as possible. Because it can be hard to get your older pictures, it’s best to find a facility that you are comfortable with and plan to get your regular mammograms there each year. That way, your mammogram pictures are all in one place.

**Tips for having a mammogram**

These tips can help you have a good quality mammogram:

- If it’s not posted in a place you can see it near the receptionist’s desk, ask to see the FDA certificate that’s issued to all facilities that offer mammograms. The FDA requires all facilities to meet high professional standards of safety and quality in order to provide mammogram services. Facilities that are not certified may not provide mammogram services.

- Use a facility that specializes in mammograms and does many mammograms a day.

- If you are satisfied that the facility is of high quality, continue to go there on a regular basis so that your mammograms can easily be compared from year to year.

- If you’re going to a facility for the first time, bring a list of the places, and dates of mammograms, biopsies, or other breast treatments you have had before.

- If you have had mammograms at another facility, you should try to get those mammograms to bring with you to the new facility (or have them sent there) so that they can be compared to the new ones.

- On the day of the exam, don’t wear deodorant or antiperspirant. Some of these contain substances that can show up on the x-ray as white spots. If you’re not returning home, you may want to take your deodorant with you to put on after your exam.

- You may find it easier to wear a skirt or pants, so that you’ll only need to remove your top and bra for the mammogram.

- Schedule your mammogram when your breasts are not tender or swollen to help reduce discomfort and get a good picture. If you are still menstruating, try to avoid the week just before your period.
• Always describe any breast changes or problems you are having to the technologist doing the mammogram. Also describe any medical history that could affect your breast cancer risk—such as surgery, hormone use, or breast cancer in your family (or if you’ve had breast cancer before). Discuss any new findings or problems in your breasts with your doctor or nurse before having the mammogram.

• Before having any type of imaging test, tell the radiologic technologist if you are breast-feeding or if you think you might be pregnant.

• If you do not hear from your doctor within 10 days, do not assume that your mammogram was normal; call your doctor or the facility.

What to expect when you have a mammogram

• You will have to undress above the waist to have a mammogram. The facility will give you a wrap to wear.

• A technologist will position your breasts for the mammogram. You and the technologist are the only ones in the room during the mammogram.

• To get a high-quality picture, the breast must be flattened. The technologist places the breast on the machine’s metal plate. The plastic upper plate is lowered to compress the breast for a few seconds while the technologist takes a picture.

• The whole procedure takes about 20 minutes. The actual breast compression only lasts a few seconds.

• You may feel some discomfort or even pain when your breasts are compressed, and for some women it can be painful.

• All mammogram facilities are now required to send your results to you within 30 days. In most cases, you will be contacted within 5 working days if there’s a problem with the mammogram.

• Being called back for more testing does not mean that you have cancer. In fact, less than 10% of women called back for more tests are found to have breast cancer. Being called back occurs fairly often. It usually just means more pictures or an ultrasound needs to be done to look at a suspicious area more carefully.

• Only 2 to 4 screening mammograms of every 1,000 lead to a diagnosis of breast cancer.

If you are a woman age 40 or over, you should get a mammogram every year. (See our document called Breast Cancer: Early Detection for the American Cancer Society breast cancer screening recommendations.) You can schedule the next one while you’re there at the facility. Or you can ask for a reminder to schedule it as the date gets closer. Some
women schedule the next year’s mammogram and ask to be reminded of the appointment a few weeks ahead of time.

Help with mammogram costs

Medicare, Medicaid, and all private health insurance policies created after March 23, 2010 cover screening mammogram costs. Most states also have laws that require health insurance companies to pay for all or at least part of the costs of screening mammograms. You typically pay more for diagnostic mammograms than screening ones, and the insurance coverage may be different.

Low-cost mammograms are available in most areas. Call the American Cancer Society at 1-800-227-2345 for information about facilities in your area. The National Breast and Cervical Cancer Early Detection Program (NBCCEDP) also provides breast and cervical cancer early detection testing to women without health insurance for free or at very little cost. To learn more about this program, please contact the Centers for Disease Control and Prevention (CDC) at 1-800-CDC INFO (1-800-232-4636) or visit their Web site at www.cdc.gov/cancer.

Regulation of mammography

In the United States, mammography is highly regulated. Although the overall quality of mammography has improved since its introduction in the late 1960s, studies done in the mid-1980s showed that quality varied greatly from place to place.

In an attempt to educate those working with mammograms, improve quality, and lower the dose of radiation, the American Cancer Society approached the American College of Radiology (ACR) and requested that it establish standards and criteria that would help women and doctors find those facilities that provided high-quality screening services. In 1986, the ACR started the first national Mammography Accreditation Program (MAP). This voluntary program raised standards nationwide and led to better mammogram services at those sites that took part in the program.

In 1992, Congress passed the Mammography Quality Standards Act (MQSA) to ensure that radiology facilities offering mammography would be required to meet minimum quality standards. Today, the US Food and Drug Administration (FDA) certifies every facility offering mammography (except those of the Department of Veterans Affairs). In order to be certified, the equipment, personnel, and practice of the facility must be reviewed by an FDA-approved accreditation body, have an on-site inspection, and meet the following criteria:

- Each mammography unit has to be accredited.
- Certain staff members must meet strict standards including:
- Radiologists (the doctors who interpret or read the mammograms)
- Radiologic technologists (those who actually position women for the mammogram and take the pictures)
- Medical physicists (professionals who specialize in medical equipment and image production)

• Typical x-rays are reviewed for quality and information on radiation dose, which is required to be very low.

If the facility meets all of the required standards, the FDA gives its certification. These standards are outlined in the MQSA, which has been in effect since 1994. It is unlawful to do mammograms in the United States without an FDA certificate.

The FDA has a list of all of its certified mammography facilities by state and zip code. This list is available at the FDA’s Web site: www.accessdata.fda.gov/scripts/cdrh/cfdocs/cfMQSA/mqsa.cfm.

**Reporting results**

Mammogram clinics must notify women in writing about the results of their mammograms. The Mammography Quality Standards Act (MQSA) requires this. Mammography clinics still report mammogram results to the woman’s doctor, too, who is responsible for ordering more tests or treatments, if needed.

As of 1999 the MQSA requires clinics to mail women a separate, easy-to-understand report of their mammogram results within 30 days—or “as quickly as possible” if the results suggest cancer is present. This means that the woman may know the results even if her doctor has not yet called to tell her.

**Radiation exposure from mammography**

The modern mammography machine uses low radiation doses to produce breast x-rays that are high in image quality. (It usually uses about 0.1 to 0.2 rads per picture; a rad is a measure of radiation dose). Older mammography units delivered higher doses, and led to concerns about radiation risks. These older machines are no longer used.

Strict guidelines ensure that mammography equipment is safe and uses the lowest dose of radiation possible. Many people are concerned about the exposure to x-rays, but the level of radiation from a mammogram today does not significantly increase the breast cancer risk for a woman who gets regular mammograms.

To put dose into perspective, if a woman with breast cancer is treated with radiation, she will likely get a total of several thousand rads. If she has yearly mammograms starting at age 40 and continues until she is 90, she will get a total of 20 to 40 rads. To put it another
way, flying from New York to California on a commercial jet exposes a woman to roughly the same amount of radiation as one mammogram.

**What does the doctor look for on a mammogram?**

A mammogram may show something suspicious, but by itself it can’t prove that an abnormal area is cancer. If a mammogram raises a suspicion of cancer, a tissue sample from the suspicious area must be removed and examined under the microscope to find out if it’s cancer. For detailed information on the types of biopsies and what you need to know, please see our document, *For Women Facing a Breast Biopsy*.

The doctor reading your mammogram will look for different types of changes.

**Calcifications**

Calcifications are tiny mineral deposits within the breast tissue. They look like small white spots on a mammogram. They may or may not be caused by cancer. There are 2 types of calcifications.

**Macrocalcifications**

Macrocalcifications are coarse (larger) calcium deposits that are most likely due to changes in the breasts caused by aging of the breast arteries, old injuries, or inflammation. These deposits are related to non-cancerous conditions and do not require a biopsy. Macrocalcifications are found in about half the women over 50, and in 1 of 10 women under 50.

**Microcalcifications**

Microcalcifications are tiny specks of calcium in the breast. They may show up alone or in clusters. Microcalcifications seen on a mammogram are of more concern than macrocalcifications, but they do not always mean that cancer is present. The shape and layout of microcalcifications help the radiologist judge how likely it is that cancer is present.

In most cases, the presence of microcalcifications does not mean a biopsy is needed. But if the microcalcifications have a suspicious look and pattern, a biopsy will be recommended. (During a biopsy, the doctor removes a small piece of the suspicious area to be looked at under a microscope. A biopsy is the only way to tell if cancer is really present.)
A mass or cyst

A mass, with or without calcifications, is another important change seen on a mammogram. Masses are areas that look abnormal and they can be many things, including cysts (non-cancerous, fluid-filled sacs) and non-cancerous solid tumors (such as fibroadenomas).

Cysts can be simple fluid-filled sacs (known as simple cysts) or can be partially solid (known as complex cysts). Simple cysts are benign (not cancer) and don’t need to be biopsied. Any other type of mass (such as a complex cyst or a solid tumor) might need to be biopsied to be sure it isn’t cancer.

A cyst and a tumor can feel the same on a physical exam. They can also look the same on a mammogram. To confirm that a mass is really a cyst, a breast ultrasound is often done. Another option is to remove (aspirate) the fluid from the cyst with a thin, hollow needle.

If a mass is not a simple cyst (that is, if it’s at least partly solid), more imaging tests may be needed. Some masses can be watched with regular mammograms, while others may need a biopsy. The size, shape, and margins (edges) of the mass may help the radiologist determine if cancer is likely to be present.

Having your prior mammograms available for the radiologist is very important. They can help show that a mass or calcification has not changed for many years. This would mean that it’s likely not cancer and a biopsy is not needed.

Breast density

Your mammogram report may also contain an assessment of breast density or state that you have dense breasts. Breast density is based on how much of your breast is made up of fatty tissue vs. how much is made up of fibrous and glandular tissue.

Dense breasts are not abnormal, but they are linked to a higher risk of breast cancer. Although dense breast tissue can make it harder to find cancers on a mammogram, at this time, experts do not agree what other tests, if any, should be done in addition to mammograms in women with dense breasts who aren’t in a high-risk group (based on gene mutations, a strong family history of breast cancer, or other factors).

Breast biopsy

A suspicious area in the breast may be found by physical exam, mammogram, or another imaging test, or by some combination of these. But no matter of how it was found, the only way to know for sure if it’s cancer is to do a biopsy. This means a sample of cells or tissue is taken from the area and looked at under the microscope. For suspicious areas that cannot be felt (and even for some that can), imaging tests may be used to be sure the
right area is biopsied. There are several types of biopsies, and it’s important for you to know which type the doctor recommends for you.

For detailed information on the types of biopsies and what you need to know, please see, *For Women Facing a Breast Biopsy*.

**Mammogram reports – BI-RADS**

The American College of Radiology (ACR) has developed a standard way of describing mammogram findings. In this system, the results are sorted into categories numbered 0 through 6. This system is called the *Breast Imaging Reporting and Data System* (BI-RADS). Having a standard way of reporting mammogram results lets doctors use the same words and terms and ensures better follow up of suspicious findings. Here’s a brief review of what the categories mean:

**X-ray assessment is incomplete**

**Category 0: Additional imaging evaluation and/or comparison to prior mammograms is needed.**

This means a possible abnormality may not be clearly seen or defined and more tests are needed, such as the use of spot compression (applying compression to a smaller area when doing the mammogram), magnified views, special mammogram views, or ultrasound.

This also suggests that the mammogram should be compared with older ones to see if there have been changes in the area over time.

**X-ray assessment is complete**

**Category 1: Negative**

There’s no significant abnormality to report. The breasts look the same (they are symmetrical) with no masses (lumps), distorted structures, or suspicious calcifications. In this case, *negative* means nothing bad was found.

**Category 2: Benign (non-cancerous) finding**

This is also a negative mammogram result (there’s no sign of cancer), but the reporting doctor chooses to describe a finding known to be benign, such as benign calcifications, lymph nodes in the breast, or calcified fibroadenomas. This ensures that others who look
at the mammogram will not misinterpret the benign finding as suspicious. This finding is recorded in the mammogram report to help when comparing to future mammograms.

**Category 3: Probably benign finding – Follow-up in a short time frame is suggested**

The findings in this category have a very good chance (greater than 98%) of being benign (not cancer). The findings are not expected to change over time. But since it’s not proven benign, it’s helpful to see if an area of concern does change over time.

Follow-up with repeat imaging is usually done in 6 months and regularly thereafter until the finding is known to be stable (usually at least 2 years). This approach helps avoid unnecessary biopsies, but if the area does change over time, it allows for early diagnosis.

**Category 4: Suspicious abnormality – Biopsy should be considered**

Findings do not definitely look like cancer but could be cancer. The radiologist is concerned enough to recommend a biopsy. The findings in this category can have a wide range of suspicion levels. For this reason, some doctors may divide this category further:

- 4A: finding with a low suspicion of being cancer
- 4B: finding with an intermediate suspicion of being cancer
- 4C: finding of moderate concern of being cancer, but not as high as Category 5

Not all doctors use these subcategories.

**Category 5: Highly suggestive of malignancy – Appropriate action should be taken**

The findings look like cancer and have a high chance (at least 95%) of being cancer. Biopsy is very strongly recommended.

**Category 6: Known biopsy-proven malignancy – Appropriate action should be taken**

This category is only used for findings on a mammogram that have already been shown to be cancer by a previous biopsy. Mammograms may be used in this way to see how well the cancer is responding to treatment.

**BI-RADS reporting for breast density**

Mammogram reports can also include an assessment of breast density. BI-RADS classifies breast density into 4 groups:
BI-RADS 1: The breast is almost entirely fat

This means that fibrous and glandular tissue makes up less than 25% of the breast.

BI-RADS 2: There are scattered fibroglandular densities

Fibrous and glandular tissue makes up from 25 to 50% of the breast.

BI-RADS 3: The breast tissue is heterogeneously dense

The breast has more areas of fibrous and glandular tissue (from 51 to 75%) that are found throughout the breast. This can make it hard to see small masses (cysts or tumors).

BI-RADS 4: The breast tissue is extremely dense

The breast is made up of more than 75% fibrous and glandular tissue. This can lead to missing some cancers.

In some states, the summary of the mammogram report that is sent to patients (sometimes called the lay summary) must contain information about breast density. This information may be worded in lay language instead of the BIRADS categories. Women whose mammograms show BI-RADS 3 or 4 for breast density may be told that they have “dense breasts.”

Limitations of mammograms

As is the case with most medical tests, mammography has limitations.

Although breast cancer screening is the best way we have now to find cancer early, finding cancer early does not always reduce a woman’s chance of dying from breast cancer. Even though mammograms can detect breast cancers too small to be felt, treating a small tumor does not always mean it can be cured. A fast-growing or aggressive cancer may have already spread before it’s found.

The value of a screening mammogram also depends on a woman’s overall health status. Detecting breast cancer early may not help prolong the life of a woman who has other kinds of serious or life-threatening health problem such as congestive heart failure, end-stage renal disease, or chronic obstructive pulmonary (lung) disease. ACS screening guidelines emphasize that women with serious health problems or short life expectancies should discuss with their doctors whether to continue having mammograms. Our guidelines also stress that age alone should not be the reason to stop having regular mammograms.
False-negative results

A false-negative mammogram appears normal even though breast cancer is present. Overall, screening mammograms miss about 1 in 5 breast cancers.

The main cause of false-negative results is high breast density. False negatives occur more often among younger women than among older women because younger women are more likely to have dense breasts. Breasts usually become less dense as women age. False-negative results can delay treatment and promote a false sense of security for the woman.

False-positive results

A false-positive mammogram looks abnormal but no cancer is actually present. Abnormal mammograms require extra testing (diagnostic mammograms, ultrasound, and sometimes biopsy) to find out if cancer is present.

False-positive results are more common in women who are younger, have dense breasts, have had breast biopsies, have breast cancer in the family, or are taking estrogen. *With annual screening, over a 10-year period the odds that a woman will have a false-positive finding are greater than 50%. The odds of a false-positive finding are highest for the first mammogram, and are lower on subsequent mammograms. Women who have prior films available for comparison reduce the odds of a false-positive finding by 50%.

False-positive mammograms can cause temporary anxiety. The extra tests needed to be sure cancer isn’t there cost time and money and also cause physical discomfort. Still, most studies of attitudes towards false positives have shown that women accept false positive findings as part of the process of finding breast cancer early.

Overdiagnosis and overtreatment

While screening mammograms can find invasive breast cancer and ductal carcinoma in situ (DCIS, cancer cells in the lining of breast ducts) that need to be treated, it’s also possible that some invasive cancers and DCIS detected on mammography will not keep growing. This means that some tumors are not life-threatening, and never would have been detected if a woman had not gotten a mammogram. Since doctors can’t tell these cancers from those that will grow and spread, our only hint that overdiagnosis may exist is through statistical analysis that compares the number of cancers found by mammography over long periods of time with the numbers of cancers that would have been expected without screening. Overdiagnosis is a concern because an overdiagnosed cancer still needs to be treated. This means that some women are treated unnecessarily. These cases would be considered overtreatment, which exposed the women to the adverse effects of cancer therapy. Because doctors often cannot be sure which cancers and cases of DCIS will become life-threatening, they are all treated. Although there is a
wide range of estimates of the percentage of breast cancers that might be overdiagnosed by mammography, the most credible estimates range from 0-10%.

**Radiation exposure**

Mammograms require very small doses of radiation. The risk of harm from this radiation is extremely low, but in theory, repeated x-rays might have the potential to cause cancer. Still, the benefits of mammography outweigh any possible harm from the radiation exposure.

Women should always let their health care providers and x-ray technologists know if there is any chance that they are pregnant, because radiation can harm a growing fetus.

**Mammograms in special circumstances**

**Mammograms in younger women**

Mammograms are more difficult to read in younger women, usually because their breast tissue is dense and this can hide a tumor on an x-ray. Since most breast cancers occur in older women, this is usually not a problem. Screening mammograms are not recommended for average-risk women under age 40.

In younger women who are at high risk for developing breast cancer (due to a gene mutation, a strong family history, or other factors), yearly breast MRIs and mammograms are recommended. For most of these women, screening should begin at age 30 years and continue for as long as the woman is in good health. But because the evidence about the best age at which to start screening is limited, this decision should be based on discussions between patients and their health care providers, taking into account personal circumstances and preferences.

Our document called *Breast Cancer: Early Detection* gives more details about the American Cancer Society breast cancer screening recommendations. It also tells you more about figuring out your breast cancer risk. Call us for a free copy (1-800-227-2345), or read it online at www.cancer.org.

**Mammograms after breast-conserving treatment**

**What is breast-conserving treatment?**

Removing the entire breast (mastectomy) is one way of treating breast cancers. But today, most breast cancers can be treated just as well with breast-conserving treatment (BCT), which does not remove the entire breast.
Lumpectomy, one type of BCT, removes the cancerous tumor and a narrow edge (margin) of the nearby normal breast tissue. Other BCTs remove less than the whole breast, but more tissue than a lumpectomy. They take out only the part of the breast where the cancer was found, along with a margin of healthy breast tissue around the tumor.

BCT is almost always followed by radiation treatment.

A woman who has had BCT will need to continue having regular mammograms of both breasts.

**Typical mammogram plan after BCT**

Most radiologists recommend that women have a mammogram of the treated breast 6 months after radiation treatment is finished. Radiation and chemotherapy both cause changes in the skin and breast tissues. These changes show up on the mammogram, making it harder to read. The changes usually peak 6 months after the radiation is completed. The mammogram done at this time serves as a new baseline for the affected breast for that woman. Future mammograms will be compared with this one to follow healing and check for recurrence (the cancer coming back).

The next exam is then 6 months later when the woman is due for her yearly mammogram of both breasts. Experts differ on the best follow-up plan from this point on. Some prefer a mammogram of the treated breast every 6 months for 2 to 3 years; others suggest that yearly mammograms are enough. Each woman should talk with her doctor about the plan that is best for her.

**Mammograms after mastectomy**

**Without breast reconstruction**

Total or simple mastectomy removes all of the breast tissue, including the nipple, but does not remove underarm lymph nodes or chest muscle tissue beneath the breast. Sometimes this surgery is done for both breasts (a double mastectomy), most often as preventive surgery in women at very high risk for breast cancer.

Modified radical mastectomy removes the breast, skin, nipple, areola, and most of the lymph nodes under the arm on the same side, leaving the chest muscles intact.

Radical mastectomy is surgery for breast cancer in which the breast, chest muscles, and all of the lymph nodes under the arm are removed. This surgery is rarely used today. It’s mainly used when the cancer has spread to the chest muscles.

Women who have had total, modified radical, or radical mastectomy for breast cancer need no further routine screening mammograms of the affected side. (If both breasts are removed, they don’t need mammograms at all.)
Mammograms are usually continued on the unaffected breast each year. This is very important, because women who have had one breast cancer are at higher risk of developing a new cancer in the other breast.

One type of mastectomy that does require a follow-up mammogram is the subcutaneous mastectomy, also called skin-sparing mastectomy. In this operation, the woman keeps her nipple and the tissue just under the skin. Enough breast tissue is left behind to require yearly screening mammograms in these women.

Any woman who is not sure what type of mastectomy she has had or whether she needs mammograms should ask her doctor.

**With breast reconstruction**

Women who have had a breast fully removed and reconstructed (rebuilt) with silicone gel or saline implants do not need routine mammograms. If the woman has had a subcutaneous mastectomy (discussed above), yearly mammograms are still needed.

After mastectomy, some women choose to have a breast shape reconstructed using tissue from their own bodies, most often the abdomen (lower stomach area). This type of reconstruction is called a TRAM (transverse rectus abdominis myocutaneous) flap reconstruction. A patient who has had a complete (not subcutaneous) mastectomy followed by TRAM flap reconstruction needs no further screening mammograms on the affected side. But if there’s an area of the TRAM flap that is of concern on the physical exam, a diagnostic mammogram may be done. Further imaging with ultrasound or MRI may also be helpful. For more on breast reconstruction, see our document *Breast Reconstruction After Mastectomy*.

**Mammograms in women with breast implants**

Women who have implants are a special challenge for mammogram screening. The x-rays used for imaging the breasts cannot go through silicone or saline implants well enough to show the breast tissue that is over or under it. This means that the part of the breast tissue covered up by the implant will not be seen on the mammogram.

In order to see as much breast tissue as possible, women with implants have 4 extra pictures (2 on each breast) as well as the 4 standard pictures taken during a screening mammogram. In these extra x-ray pictures, called *implant displacement* (ID) views, the implant is pushed back against the chest wall and the breast is pulled forward over it. This allows better imaging of the front part of each breast. Implant displacement views do not work as well in women who have had hard scar tissue form around the implants (*contractures*). They are easier in women whose implants are placed underneath (behind) the chest muscle.
Although these women do have more pictures taken at each mammogram, the guidelines for how often women with implants should have screening mammograms are the same as for women without them. (See Breast Cancer: Early Detection for the American Cancer Society’s breast cancer screening guidelines.)

A ruptured (burst) implant can sometimes be diagnosed on a mammogram, but a ruptured implant will often look normal. Magnetic resonance imaging (MRI), on the other hand, is extremely good at finding an implant rupture. MRI is the best way to check the implant itself, while mammography is still the best test for evaluating breast tissue. See the section, “Other breast imaging tests” in this document for more information on MRI.

Very rarely, mammograms can cause an implant to rupture. It’s very important to tell the technologist if you have implants.

**Improving mammograms**

Although a mammogram is an excellent way to find most breast cancers when they are small and most curable, it does not detect all breast cancers. Newer techniques are being looked at to try to make mammograms more accurate.

**Computer-aided detection and diagnosis**

Computer-aided detection and diagnosis (CAD) was developed to help radiologists find suspicious changes on mammograms. This technology can be used with standard film mammograms or with digital mammograms.

Computers can help doctors find abnormal areas on a mammogram by acting as a second set of eyes. For standard mammograms, the film is fed into a machine which converts the image into a digital signal that is then analyzed by the computer. The technology can also be applied to an image captured with a digital mammogram. The computer then displays the picture on a video screen, with markers pointing to areas the radiologist should check more closely.

Early research on CAD showed a clear improvement in finding small cancers, with only a small increase in the number of women who had to come back for more tests. But studies of CAD in community practice have shown mixed results. Some showed a clear benefit from the use of CAD, and others showed that it did not find more cancers or find cancers earlier, but did increase the number of women who needed to come back for more tests and/or to have breast biopsies. Current research suggests that CAD is not a substitute for experience and expertise in reading mammograms. In other words, CAD is only helpful when the radiologists are experienced and have expertise in reading mammograms.
Tomosynthesis (3D mammography)

This technology is basically an extension of a digital mammogram. For this test, the breast is compressed once and a machine takes many low-dose x-rays as it moves over the breast. The images can then be combined into a 3-dimensional picture. Although this uses more radiation than most standard 2-view mammograms, the dose still is below the maximum dose allowed by the Mammography Quality Standards Act. This technology may allow doctors to see problem areas more clearly, which can mean fewer patients will need to be called back for more tests.

A breast tomosynthesis machine was approved by the Food and Drug Administration (FDA) in 2011 for use in the United States, but the role of this technology in screening and diagnosis is still not clear. Not all health insurance covers tomosynthesis, so you may want to check with your insurance company if this is recommended for you.

Other breast imaging tests

While mammograms are the most useful tests for screening and finding breast cancer early, other imaging tests may be helpful in some cases.

MRI (magnetic resonance imaging)

MRI scans use magnets and radio waves instead of x-rays to produce very detailed, cross-sectional pictures of the body. 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 of parts of the body. 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.

Breast MRI is mainly used for 2 purposes:

For women who have been diagnosed with breast cancer, to help measure the size of the cancer and look for any other tumors in the breast. It’s also used to look at the opposite breast, to be sure that it doesn’t contain any tumors.

For certain women at high risk for breast cancer, screening MRI is recommended along with a yearly mammogram. MRI is not recommended as a screening tool by itself, as it can miss some cancers that a mammogram would detect.

Just as mammograms are done with x-ray machines that are specially designed to image the breasts, breast MRI also requires special equipment. Breast MRI machines produce higher quality images than MRI machines designed for head, chest, or abdominal scanning. But there are hospitals and imaging centers that do not have dedicated breast MRI equipment available.
It’s important that screening MRIs be done at facilities that also can do an MRI-guided breast biopsy. Otherwise, the entire scan will need to be repeated at another facility if a biopsy is needed.

MRIs cost more than mammograms. Most major insurance companies pay for these screening tests if a woman can be shown to be at high risk, but it’s a good idea to check with your insurance company before having the test. There are still some concerns about costs and limited access to high-quality MRI breast screening services for women at high risk of breast cancer.

When getting ready for a breast MRI, you can eat and drink as usual. You will need to take off clothes with metal parts such as zippers, snaps, or buttons, and put on a gown or top. Jewelry, hairpins, safety pins, and anything else made of metal must be removed before you go into the MRI room. The technologist will ask if you have any metal in your body, such as surgical clips, staples, implanted catheters, pacemakers, artificial joints, metal fragments, tattoos, permanent eyeliner, and so on. Some metal objects will not cause problems, but others might. Tell the staff before the scan if you have any allergies, if you have breast implants, or if you are pregnant or breast-feeding.

You may need to have an IV put in so you can get contrast dye to help outline the structures of the breast. For the actual MRI, you will lie on your stomach on a padded platform with spaces for your breasts. You will need to be very still during the test, which can take up to an hour.

Breast ultrasound

Ultrasound, also known as sonography, uses sound waves to look inside a part of the body. A gel is put on the skin of the breast and a handheld instrument called a transducer is rubbed with gel and pressed against the skin. 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 on a computer screen. This test is painless and does not expose you to radiation.

Breast ultrasound is sometimes used to evaluate breast problems that are found during a screening or diagnostic mammogram or on physical exam. Breast ultrasound is not routinely used for screening. Some studies have suggested that it may be helpful to use ultrasound along with a mammogram when screening high risk women with dense breast tissue (which is hard to evaluate with a mammogram). But at this time, ultrasounds cannot replace mammograms. More studies are needed to figure out if ultrasound should be added to routine screening mammograms for some groups of women.

Ultrasound is useful for taking a closer look at some breast masses, and it’s the only way to tell if a suspicious area is a cyst without putting a needle into it to take out (aspirate) fluid. Breast ultrasound may also be used to help doctors guide a biopsy needle into an area of concern in the breast.
There is a newer system, called a *3-dimensional automated ultrasound*, which can be used on the breast. The FDA has approved it to be used along with mammography. The 3-D ultrasound can be done with a handheld transducer, but more often the breast is covered with gel before a larger unit is placed over the entire breast area and left in place as the machine gets images from different angles.

Ultrasound has become a valuable tool to use along with mammograms because it’s widely available, non-invasive, and costs less than other options. But the value of an ultrasound test depends on the operator’s level of skill and experience—though this is less important with the new automated ultrasound systems. Ultrasound is less sensitive than MRI (that is, it detects fewer tumors), but it has the advantages of costing less and being more widely available.

**Ductogram (galactogram)**

A ductogram, also called a galactogram, is sometimes used to help find the cause of nipple discharge. In this test, a very thin plastic tube is put into the opening of a duct in the nipple that the discharge coming from. A small amount of contrast material is put in. It outlines the shape of the duct on x-ray and can show whether there is a mass inside the duct.

**Experimental and other breast imaging methods**

Research in the field of breast imaging is being done to

- Find more cancers even before they can be felt by the patient or her doctor
- Find even smaller cancers than those now detected by mammograms
- Find better ways to tell the difference between benign (not cancer) breast conditions and breast cancers

Tests being developed for these purposes need more study before their usefulness can be determined. Even though some of these imaging tests have been FDA approved for use along with mammography and other proven test methods, their place in the diagnosis or screening of breast cancer is less clear-cut.

**Nuclear medicine studies**

For nuclear medicine studies (also called nuclear scans) small amounts of slightly radioactive substances are injected into the body and special cameras are used to see where they go. Depending on the substance used, different types of abnormalities may be found. Unlike most other imaging tests that are based on changes tumors cause in the
body’s structure, nuclear medicine scans depend on changes in tissue metabolism. A couple of newer subtypes of nuclear medicine studies are described below under “Other experimental breast imaging tests.”

**Scintimammography (molecular breast imaging)**

A radioactive tracer known as technetium sestamibi has been studied to help detect breast cancer. For this test, a small amount of the radioactive tracer is put into a vein. The tracer attaches to breast cancer cells and is detected by a special camera.

This test cannot show whether an abnormal area is cancer as accurately as a mammogram, and it’s not used as a screening test. Some radiologists believe this test may be helpful in looking at suspicious areas found by mammogram. But the exact role of scintimammography is still 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 MRI scans. More research is needed.

**Electrical impedance imaging (T-scan™)**

Electrical impedance imaging (EIT) scans the breast for electrical conductivity. It’s based on the idea that breast cancer cells conduct electricity in a different way than normal cells. The test passes a very small electrical current through the breast and then detects it on the skin of the breast. This is done using small electrodes that are taped to the skin. EIT does not use radiation or compress the breasts.

This test is FDA approved as a diagnostic aid in helping classify tumors found on mammogram. But at this time it has not had enough clinical testing to be used in breast cancer screening.

**Thermography (thermal imaging)**

Thermography is a way to measure and map the heat on the surface of the breast using a special heat-sensing camera. It’s based on the idea that the temperature rises in areas with increased blood flow and metabolism, which could be a sign of a tumor.

Thermography has been around for many years, but studies have shown that it’s not an effective screening tool for finding breast cancer early. Although it has been promoted as helping detect breast cancer early, a 2012 research review found that thermography detected only a quarter of the breast cancers found by mammography. Thermography should not be used as a substitute for mammograms.
Other experimental breast imaging tests

Some newer techniques are now being studied for breast imaging. These tests are in the earliest stages of research. It will take time to see if any of these imaging tests are as good as or better than those we use today.

**Optical imaging** tests either pass light through the breast or reflect light off it and then measure the light that returns. The technique does not use radiation and does not require breast compression. Optical imaging might be useful at some point for detecting tumors or the blood vessels that supply them.

**Molecular breast imaging (MBI)** is a new nuclear medicine imaging technique for the breast. It’s being tested to see if it may be a less expensive and more specific way to identify breast changes that have been seen on a mammogram or ultrasound. At this time it’s still in the early research stages.

**Positron Emission Mammography (PEM)** is another newly developed imaging exam of the breast. It uses an FDA-approved sugar attached to a radioactive particle to detect cancer cells. The PEM scanner is also FDA approved. Working much like a PET scan, a PEM scan may be better able to detect clusters of cancer cells within the breast. PEM may be able to show breast cancer before it can be seen with mammograms and might prove to be as good as or better than breast MRI. A number of studies are under way.

To learn more

More information from your American Cancer Society

The following related information may also be helpful to you. Free copies of these materials may be ordered from our toll-free number, 1-800-227-2345, or you can read most of them online at www.cancer.org.

**More on checking women for breast cancer**

Breast Cancer Early Detection (also in Spanish)
Non-Cancerous Breast Conditions (also in Spanish)
For Women Facing a Breast Biopsy (also in Spanish)

**If you or someone you love has breast cancer**

After Diagnosis: A Guide for Patients and Families (also in Spanish)
Breast Cancer Detailed Guide (also in Spanish)
Breast Cancer Overview (shorter and easier to read than the Detailed Guide; also in Spanish)

Inflammatory Breast Cancer

Breast Cancer in Men Detailed Guide

Breast Cancer Dictionary (also in Spanish)

Breast Reconstruction After Mastectomy (also in Spanish)

Talking With Your Doctor (also in Spanish)

National organizations and Web sites*

Along with the American Cancer Society, other sources of information and support include:

**Centers for Disease Control and Prevention (CDC)**
**National Breast and Cervical Cancer Early Detection Program (NBCCEDP)**
Toll-free number: 1-800-232-4636 (1-800-CDC-INFO)
Web site: www.cdc.gov/cancer/nbccedp/

To find out more about the NBCCEDP, which provides breast and cervical cancer early detection testing for women without coverage for free or at very little cost

**National Cancer Institute**
Toll-free number: 1-800-422-6237 (1-800-4-CANCER)
Web site: www.cancer.gov

Offers current information about breast cancer screening, diagnosis, and treatment as well as information on many other types of cancer

**American College of Radiology (ACR)**
Toll-free number: 1-800-227-5463
Web site: www.acr.org

Offers information on radiology procedures, radiation safety, FAQs, and a radiology glossary in the “Patient and Family Resources” section, as well as an “Accredited Facility Search”

*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 cancer-related information and support. Call us at **1-800-227-2345** or visit www.cancer.org.
References


Last Medical Review: 12/17/2012
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