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## Mammography

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*This procedure is reviewed by a physician with expertise in the area presented and is further reviewed by committees from the American College of Radiology (ACR) and the Radiological Society of North America (RSNA), comprising physicians with expertise in several radiologic areas.*

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### What is Mammography?

Mammography is a specific type of imaging that uses a low-dose x-ray system to examine breasts. A mammography exam, called a mammogram, is used to aid in the diagnosis of breast diseases in women.

An x-ray (radiograph) is a painless medical test that helps physicians diagnose and treat medical conditions. Radiography involves exposing a part of the body to a small dose of ionizing radiation to produce pictures of the inside of the body. X-rays are the oldest and most frequently used form of medical imaging.

Two recent enhancements to traditional mammography include digital mammography and computer-aided detection.

**Digital mammography**, also called full-field digital mammography (FFDM), is a mammography system in which the x-ray film is replaced by solid-state detectors that convert x-rays into electrical signals. These detectors are similar to those found in digital cameras. The electrical signals are used to produce images of the breast that can be seen on a computer screen or printed on special film similar to conventional mammograms. From the patient's point of view, digital mammography is essentially the same as the screen-film system.

**Computer-aided detection (CAD)** systems use a digitized mammographic image that can be obtained from either a conventional film mammogram or a digitally acquired mammogram. The computer software then searches for abnormal areas of density, mass, or calcification that may indicate the presence of cancer. The CAD system highlights these areas on the images, alerting the radiologist to the need for further analysis.

### What are some common uses of the procedure?

Mammograms are used as a screening tool to detect early breast cancer in women experiencing no symptoms and to detect and diagnose breast disease in women experiencing symptoms such as a lump, pain or nipple discharge.

#### Screening Mammogram

Mammography plays a central part in early detection of breast cancers because it can show changes in the breast up to two years before a patient or physician can feel them. Current guidelines from the U.S. Department of Health and Human Services (HHS), the American Cancer Society (ACS), the American Medical Association (AMA) and the American College of Radiology (ACR) recommend screening mammography every year for women, beginning at age 40. Research has shown that annual mammograms lead to early detection of breast cancers, when they are most curable and breast-conservation therapies are available.

The National Cancer Institute (NCI) adds that women who have had breast cancer and those who are at increased risk due to a genetic history of breast cancer should seek expert medical advice about whether they should begin screening before age 40 and about the frequency of screening.

#### Diagnostic Mammogram

Diagnostic mammography is used to evaluate a patient with abnormal clinical findings—such as a breast lump or lumps—that have been found by the woman or her doctor. Diagnostic mammography may also be done after an abnormal screening mammography in order to determine the cause of the area of concern on the screening exam.

## How should I prepare?

Before scheduling a mammogram, the American Cancer Society (ACS) and other specialty organizations recommend that you discuss any new findings or problems in your breasts with your doctor. In addition, inform your doctor of any prior surgeries, hormone use, and family or personal history of breast cancer.

Do not schedule your mammogram for the week before your period if your breasts are usually tender during this time. The best time for a mammogram is one week following your period. Always inform your doctor or x-ray technologist if there is any possibility that you are pregnant.

The ACS also recommends you:

- Do not wear deodorant, talcum powder or lotion under your arms or on your breasts on the day of the exam. These can appear on the mammogram as calcium spots.
- Describe any breast symptoms or problems to the technologist performing the exam.
- If possible, obtain prior mammograms and make them available to the radiologist at the time of the current exam.
- Ask when your results will be available; do not assume the results are normal if you do not hear from your doctor or the mammography facility.

## What does the mammography equipment look like?



A mammography unit is a rectangular box that houses the tube in which x-rays are produced. The unit is used exclusively for x-ray exams of the breast, with special accessories that allow only the breast to be exposed to the x-rays. Attached to the unit is a device that holds and

compresses the breast and positions it so images can be obtained at different angles.



## How does the procedure work?

X-rays are a form of radiation, like light or radio waves that can be focused into a beam. X-rays pass through most objects, including the body. Once it is carefully aimed at the part of the body being examined, an x-ray machine produces a small burst of radiation that passes through the body, recording an image on photographic film or a special image recording plate.

Different parts of the body absorb the x-rays in varying degrees. Dense bone absorbs much of the radiation while soft tissue, such as muscle, fat and organs, allow more of the x-rays to pass through them. As a result, bones appear white on the x-ray, soft tissue shows up in shades of gray and air appears black.

X-ray images are maintained as hard film copy (much like a photographic negative) or, more likely, as a digital image that is stored electronically. These stored images are easily accessible and are sometimes compared to current x-ray images for diagnosis and disease management.

## How is the procedure performed?

Mammography is performed on an outpatient basis.

During mammography, a specially qualified radiologic technologist will position your breast in the mammography unit. Your breast will be placed on a special platform and compressed with a paddle (often made of clear Plexiglas or other plastic). The technologist will gradually compress your breast.

Breast compression is necessary in order to:

- Even out the breast thickness so that all of the tissue can be visualized.

- Spread out the tissue so that small abnormalities won't be obscured by overlying breast tissue.
- Allow the use of a lower x-ray dose since a thinner amount of breast tissue is being imaged.
- Hold the breast still in order to eliminate blurring of the image caused by motion.
- Reduce x-ray scatter to increase sharpness of picture.
- The technologist will stand behind a glass shield during the x-ray exposure. You will be asked to change positions slightly between images. The routine views are a top-to-bottom view and an oblique side view. The process will be repeated for the other breast.

The patient must hold very still and may be asked to keep from breathing for a few seconds while the x-ray picture is taken to reduce the possibility of a blurred image. The technologist will walk behind a wall or into the next room to activate the x-ray machine.

When the examination is completed, the patient will be asked to wait until the technologist determines that the images are of high enough quality for the radiologist to read.

The examination process should take about 30 minutes.

## What will I experience during and the procedure?

You will feel pressure on your breast as it is squeezed by the compressor. Some women with sensitive breasts may experience discomfort. If this is the case, schedule the procedure when your breasts are least tender. Be sure to inform the technologist if pain occurs as compression is increased. If discomfort is significant, less compression will be used.

## Who interprets the results and how do I get them?

A radiologist, a physician specifically trained to supervise and interpret radiology examinations, will analyze the images and send a signed report to your primary care or referring physician, who will share the results with you.

You will also be notified of the results by the mammography facility.

## What are the benefits vs. risks?

### Benefits

- Imaging of the breast improves a physician's ability to detect small tumors. When cancers are small, the woman has more treatment options and a cure is more likely.
- The use of screening mammography increases the detection of small abnormal tissue growths confined to the milk ducts in the breast, called ductal carcinoma in situ (DCIS). These early tumors cannot harm patients if they are removed at this stage and mammography is the only proven method to reliably detect these tumors. It is also useful for detecting all types of breast cancer, including invasive ductal and invasive lobular cancer.
- No radiation remains in a patient's body after an x-ray examination.
- X-rays usually have no side effects.

### Risks

- There is always a slight chance of damage to cells or tissue from radiation. However, the radiation risk is very low compared with the potential benefits.
- The effective radiation dose from a mammogram is about 0.7 mSv, which is about the same as the average person receives from background radiation in three months. Federal mammography guidelines require that each unit be checked by a medical physicist every year to ensure that the unit operates correctly.
- False Positive Mammograms. Five percent to 15 percent of screening mammograms require more testing such as additional mammograms or ultrasound. Most of these tests turn out to be normal. If there is an abnormal finding a follow-up or biopsy may have to be performed. Most of the biopsies confirm that no cancer was present. It is estimated that a woman who has yearly mammograms between ages 40 and 49 has about a 30 percent chance of having a false-positive mammogram at some point in that decade and about a 7 percent to 8 percent chance of having a breast biopsy within the 10-year period. The estimate for false-positive mammograms is about 25 percent for women ages 50 or older.
- Women should always inform their doctor or x-ray technologist if there is any possibility that they are pregnant.

### ***A Word About Minimizing Radiation Exposure***

Special care is taken during x-ray examinations to use the lowest radiation dose possible while producing the best images for evaluation. National and international radiology protection councils continually review and update the technique standards used by radiology professionals.

State-of-the-art x-ray systems have tightly controlled x-ray beams with significant filtration and dose control methods to minimize stray or scatter radiation. This ensures those parts of a patient's body not being imaged receive minimal radiation exposure.

## **What are the limitations of Mammography?**

Initial mammographic images themselves are not always enough to determine the existence of a benign or malignant disease with certainty. If a finding or spot seems suspicious, your radiologist may recommend further diagnostic studies.

Interpretations of mammograms can be difficult because a normal breast can appear differently for each woman. Also, the appearance of an image may be compromised if there is powder or salve on the breasts or if you have undergone breast surgery. Because some breast cancers are hard to visualize, a radiologist may want to compare the image to views from previous examinations. Not all cancers of the breast can be seen on mammography.

Breast implants can also impede accurate mammogram readings because both silicone and saline implants are not transparent on x-rays and can block a clear view of the tissues behind them, especially if the implant has been placed in front of, rather than beneath, the chest muscles. But the NCI says that experienced technologists and radiologists know how to carefully compress the breasts to improve the view without rupturing the implant.

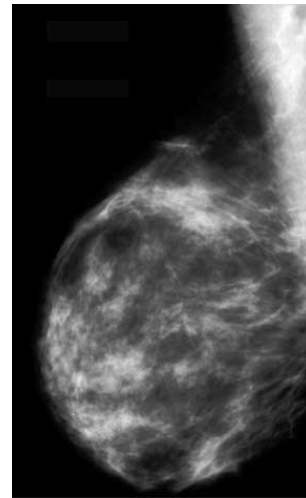
When making an appointment for a mammogram, women with implants should ask if the facility uses special techniques designed to accommodate them. Before the mammogram is taken, they should make sure the technologist is experienced in performing mammography on patients with breast implants.

While mammography is the best screening tool for breast cancer available today, mammograms do not detect all breast cancers. Also, a small portion of mammograms indicate cancer is present when it is not (called a false-positive result).

Research is being done on a variety of breast imaging techniques that can contribute to the early detection of

breast cancer and improve the accuracy in distinguishing non-cancerous breast conditions from breast cancers.

Computer-aided detection (CAD) systems and digital mammography are some of the new technologies under study.



*Normal mammogram*

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