

## Breast Ultrasound

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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 Ultrasound Imaging of the Breast?

Ultrasound imaging, also called ultrasound scanning or sonography, involves exposing part of the body to high-frequency sound waves to produce pictures of the inside of the body. Ultrasound exams do not use ionizing radiation (x-ray). Because ultrasound images are captured in real-time, they can show the structure and movement of the body's internal organs, as well as blood flowing through blood vessels.

Ultrasound imaging is usually a painless medical test that helps physicians diagnose and treat medical conditions.

Ultrasound imaging of the breast produces a picture of the internal structures of the breast.

A Doppler ultrasound study may be part of a breast ultrasound examination.

Doppler ultrasound is a special ultrasound technique that evaluates blood as it flows through a blood vessel, including the body's major arteries and veins in the abdomen, arms, legs and neck.

During a breast ultrasound examination the sonographer or physician performing the test may use Doppler techniques to evaluate blood flow or lack of flow in any breast mass. This may in some cases provide additional information as to the cause of the mass.

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

- Determining the nature of a breast abnormality

The primary use of breast ultrasound today is to help diagnose breast abnormalities detected by a physician during a physical exam and to characterize potential abnormalities seen on mammography.

Ultrasound imaging can help to determine if an abnormality is solid (which may be a non-cancerous lump of tissue or a cancerous tumor) or fluid-filled (such as a benign cyst). Ultrasound can also help show additional features of the abnormal area.

Doppler ultrasound is used to assess blood supply in breast lesions.

- Supplemental breast cancer screening

Mammography is the only screening tool for breast cancer that is known to reduce deaths due to breast cancer through early detection. Even so, mammograms do not detect all breast cancers. Some breast lesions and abnormalities are not visible or are difficult to interpret on mammograms. In breasts that are dense, meaning there is a lot of breast tissue and less fat, many cancers can be hard to see on mammography. Over half of women under age 50, and about a third of women over age 50, have dense breasts.

Medical studies are currently being done to determine whether ultrasound and other imaging methods can help supplement mammography by detecting small breast cancers that may not be visible with mammography. It is hoped that by detecting such cancers, these other screening tests might help prevent deaths due to breast cancer.

Today, ultrasound is being investigated for use as a screening tool for women who:

- have dense breasts
- have silicone breast implants and very little tissue can be included on the mammogram
- are pregnant or should not to be exposed to x-rays (which is necessary for a mammogram)
- are at high risk for breast cancer based on family history

- Ultrasound-guided breast biopsy

When an ultrasound examination cannot characterize the nature of a breast abnormality, a physician may choose to perform an ultrasound-guided biopsy. Because ultrasound provides real-time images, it is often used to guide biopsy procedures.

A breast biopsy involves removing some cells—either surgically or in a less invasive procedure involving a needle—from the suspicious area in the breast and examining them under a microscope to determine a diagnosis.

Ultrasound-guidance is used to assist physicians in obtaining tissue samples from the breast in three different biopsy procedures: a cyst aspiration, a fine needle aspiration (FNA) biopsy and a core needle (CN) biopsy.

For more information on this procedure, please refer to Ultrasound-guided Breast Biopsy on the Radiology Info.org Web site.

## How should I prepare?

You will be asked to undress from the waist up and to wear a gown during the procedure.

## What does the equipment look like?

Ultrasound scanners consist of a console containing a computer and electronics, a video display screen and a transducer that is used to scan the body. The transducer is a small hand-held device that resembles a microphone, attached to the scanner by a cord. The transducer sends out a high frequency sound wave and then listens for a returning sound wave or “echo”.



The ultrasound image is immediately visible on a nearby screen that looks much like a computer or television monitor. The image is created based on the amplitude (strength), frequency and time it takes for the sound signal to return from the patient to the transducer.

## How does the procedure work?

Ultrasound imaging is based on the same principles involved in the sonar used by bats, ships and fishermen. When a sound wave strikes an object, it bounces backward, or echoes. By measuring these echo waves it is possible to determine how far away the object is and its size, shape, consistency (whether the object is solid, filled with fluid, or both) and uniformity.

In medicine, ultrasound is used to detect changes in appearance and function of organs, tissues, or abnormal masses, such as tumors.

In an ultrasound examination, a transducer both sends the sound waves and records the echoing waves. When the transducer is pressed against the skin, it directs a stream of inaudible, high-frequency sound waves into the body. As the sound waves bounce off of internal organs, fluids and tissues, the sensitive microphone in the transducer records tiny changes in the sound's pitch and direction. These signature waves are instantly measured and displayed by a computer, which in turn creates a real-time picture on the monitor. These live images are usually recorded on videotape and one or more frames of the moving pictures are typically captured as still images.

Doppler ultrasound, a special application of ultrasound, measures the direction and speed of blood cells as they move through vessels. The movement of blood cells causes a change in pitch of the reflected sound waves (Doppler effect). A computer collects and processes the sounds and creates graphs or pictures that represent the flow of blood through the blood vessels.

## How is the procedure performed?

You will lie on your back with your arm raised above your head on the examining table.

A clear gel is applied to the area of the body being studied to help the transducer make secure contact with the body and eliminate air pockets between the transducer and the skin. The sonographer (ultrasound technologist) or radiologist then presses the transducer firmly against the skin and sweeps it back and forth over the area of interest.

Doppler sonography is performed using the same transducer.

When the examination is complete, the patient may be asked to dress and wait while the ultrasound images are reviewed. However, the sonographer or radiologist is often able to review the ultrasound images in real-time as

they are acquired and the patient can be released immediately.

This ultrasound examination is usually completed within 30 minutes.

## What will I experience during and after the procedure?

Most ultrasound examinations are painless, fast and easy.

After you are positioned on the examination table, the radiologist or sonographer will spread some warm gel on your skin and then press the transducer firmly against your body, moving it back and forth over the area of interest until the desired images are captured. There may be varying degrees of discomfort from pressure as the transducer is pressed against the area being examined.

If scanning is performed over an area of tenderness, you may feel pressure or minor pain from the procedure.

If a Doppler ultrasound study is performed, you may actually hear pulse-like sounds that change in pitch as the blood flow is monitored and measured.

You may be asked to change positions during the exam.

Once the imaging is complete, the gel will be wiped off your skin.

After an ultrasound exam, you should be able to resume your normal activities.

## 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. In some cases the radiologist may discuss preliminary results with you at the conclusion of your examination.

## What are the benefits vs. risks?

### Benefits

- Ultrasound scanning is noninvasive (no needles or injections) and is usually painless.
- Ultrasound is widely available, easy-to-use and less expensive than other imaging methods.

- Ultrasound imaging uses no ionizing radiation.
- Ultrasound scanning gives a clear picture of soft tissues that do not show up well on x-ray images.
- Ultrasound causes no health problems and may be repeated as often as is necessary if medically indicated.
- Ultrasound provides real-time imaging, making it a good tool for guiding minimally invasive procedures such as needle biopsies and needle aspiration of fluid in joints or elsewhere.
- Ultrasound imaging can help detect lesions in women with dense breasts.
- Ultrasound may help detect and classify a breast lesion that cannot be interpreted adequately through mammography.
- Using ultrasound, physicians are able to determine that many areas of concern are due to normal tissue (such as fat lobules) or benign cysts. For most women 30 years of age and older, a mammogram will be used together with ultrasound. For women under age 30, ultrasound alone is often sufficient to determine whether an area of concern needs a biopsy or not.

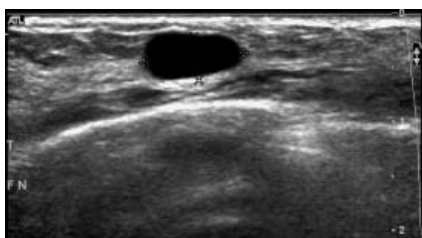
### Risks

- For standard diagnostic ultrasound there are no known harmful effects on humans.
- Interpretation of a breast ultrasound examination may lead to additional procedures such as follow-up ultrasound and/or aspiration or biopsy. Many of the areas thought to be of concern on an ultrasound turn out to be non-cancerous.

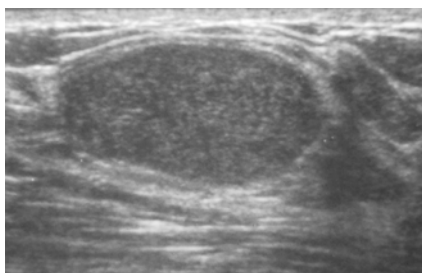
## What are the limitations of Ultrasound Imaging of the Breast?

- Ultrasound is one of the tools used in breast imaging, but it does not replace annual mammography and careful clinical and self breast examination.
- Many cancers are not visible on ultrasound.
- In some cases, ultrasound is not able to determine whether a mass is cancerous, and a biopsy will be recommended.

- Many calcifications seen on mammography cannot be seen on ultrasound. Some early breast cancers only show up as calcifications on mammography.
  - Many facilities do not offer ultrasound screening, and the procedure may not be covered by some insurance plans.
  - It is important to choose a facility with expertise in breast ultrasound, preferably one where the radiologists specialize in breast imaging. Ultrasound depends on the abnormality being recognized at the time of the scan. This requires experience and good equipment. One measure of a facility's expertise in breast ultrasound can be found in its ACR accreditation status. Check the facilities in your area by searching the ACR-accredited facilities database.
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*Ultrasound of benign cyst. A cyst is a non-cancerous fluid-filled structure in the breast. Ultrasound is necessary to make the diagnosis.*



*Ultrasound of benign fibroadenoma. Unlike a cyst, a fibroadenoma (solid benign tumor of the breast) has internal echoes or dots on ultrasound. Unfortunately, ultrasound is not 100% accurate in telling a fibroadenoma from breast cancer, so a biopsy may be necessary.*

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