



## Ultrasound - Breast

Ultrasound imaging of the breast uses sound waves to produce pictures of the internal structures of the breast. It is primarily used to help diagnose breast lumps or other abnormalities your doctor may have found during a physical exam, mammogram or breast MRI. Ultrasound is safe, noninvasive and does not use radiation.

This procedure requires little to no special preparation. Leave jewelry at home and wear loose, comfortable clothing. You will be asked to undress from the waist up and to wear a gown during the procedure.



## What is Ultrasound Imaging of the Breast?

Ultrasound is safe and painless, and produces pictures of the inside of the body using sound waves. Ultrasound imaging, also called ultrasound scanning or sonography, involves the use of a small transducer (probe) and ultrasound gel placed directly on the skin. High-frequency sound waves are transmitted from the probe through the gel into the body. The transducer collects the sounds that bounce back and a computer then uses those sound waves to create an image. Ultrasound examinations do not use ionizing radiation (as used in x-rays), thus there is no radiation exposure to the patient. 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 a noninvasive medical test that helps physicians diagnose and treat medical conditions.

Doppler ultrasound, also called color Doppler ultrasonography, is a special ultrasound technique that allows the physician to see and evaluate blood flow through arteries and veins in the abdomen, arms, legs, neck and/or brain (in infants and children) or within various body organs such as the liver or kidneys.

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

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. In some cases, this may

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 is to help diagnose breast abnormalities detected by a physician during a physical exam (such as a lump) and to characterize potential abnormalities seen on mammography or breast magnetic resonance imaging (MRI).

Ultrasound imaging can help to determine if an abnormality is solid (which may be a non-cancerous lump of tissue or a cancerous tumor), fluid-filled (such as a benign cyst) or both cystic and solid.

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. Breasts that are considered dense have a lot of glandular and connective tissues and not much fatty tissue, and that makes cancer harder to detect.

Many studies have shown that ultrasound and magnetic resonance imaging (MRI) can help supplement mammography by detecting breast cancers that may not be visible with mammography. Your doctor can help you determine if either of these tests is appropriate for you. MRI is more sensitive than ultrasound in depicting breast cancer, but MRI may not be available to all women. If screening MRI is performed, then screening ultrasound is not needed, though ultrasound may be used to characterize and biopsy abnormalities seen on MRI. When ultrasound is used for screening, abnormalities not visible with mammography may be identified, including some that may require biopsy. Many of the abnormalities found with screening breast ultrasound are not cancer (false positives). See the Breast Cancer Screening page for more information.

Ultrasound can be offered as a screening tool for women who:

- are at high risk for breast cancer and unable to undergo an MRI examination.
- are pregnant or should not be exposed to x-rays (which are necessary for a mammogram).
- have increased breast density — when the breasts have a lot of glandular and connective tissue and not much fatty tissue (see the Dense Breasts page for more information).

### • **Ultrasound-guided Breast Biopsy**

When an ultrasound examination reveals a suspicious 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. An ultrasound exam will usually need to be performed before the biopsy in order to plan the procedure and to determine if this method of biopsy can be used.

See the Ultrasound-guided Breast Biopsy page for more information.

## How should I prepare?

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

## 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 do the scanning. The transducer is a small hand-held device that resembles a microphone, attached to the scanner by a cord. Some exams may use different transducers (with different capabilities) during a single exam. The transducer sends out high-frequency sound waves (that the human ear cannot hear) into the body and then listens for the returning echoes from the tissues in the body. The principles are similar to sonar used by boats and submarines.

The ultrasound image is immediately visible on a video display screen that looks like a computer or television monitor. The image is created based on the amplitude (loudness), frequency (pitch) and time it takes for the ultrasound signal to return from the area within the patient that is being examined to the transducer (the device placed on the patient's skin to send and receive the returning sound waves), as well as the type of body structure and composition of body tissue through which the sound travels. A small amount of gel is put on the skin to allow the sound waves to travel from the transducer to the examined area within the body and then back again. Ultrasound is an excellent modality for some areas of the body while other areas, especially air-filled lungs, are poorly suited for ultrasound.

## 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 back, or echoes. By measuring these echo waves, it is possible to determine how far away the object is as well as the object's size, shape and consistency (whether the object is solid or filled with fluid).

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

In an ultrasound examination, a transducer both sends the sound waves into the body and receives the echoing waves. When the transducer is pressed against the skin, it directs small pulses of inaudible, high-frequency sound waves into the body. As the sound waves bounce off internal organs, fluids and tissues, the sensitive receiver 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. One or more frames of the moving pictures are typically captured as still images. Short video loops of the images may also be saved.

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 (called the Doppler effect). A computer collects and processes the sounds and creates graphs or color pictures that represent the flow of blood through the blood vessels.

## How is the procedure performed?

You will lie on your back on the examining table and may be asked to raise your arm above your head.

After you are positioned on the examination table, the radiologist (a physician specifically trained to supervise and interpret radiology examinations) or sonographer will apply a warm water-based gel to the area of the body being studied. The gel will help the transducer make secure contact with the body and eliminate air pockets between the transducer and the skin that can block the sound waves from passing into your body. The transducer is placed on the body and moved back and forth over the area of interest until the desired images are captured.

There is usually no discomfort from pressure as the transducer is pressed against the area being examined. However, if scanning is performed over an area of tenderness, you may feel pressure or minor pain from the transducer.

Doppler sonography is performed using the same transducer.

Once the imaging is complete, the clear ultrasound gel will be wiped off your skin. Any portions that are not wiped off will dry quickly. The ultrasound gel does not usually stain or discolor clothing.

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

Ultrasound examinations are painless and easily tolerated by most patients.

Breast ultrasound is usually completed within 30 minutes.

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.

When the examination is complete, you may be asked to dress and wait while the ultrasound images are reviewed.

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

## 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 physician, or to the physician or other healthcare provider who requested the exam. Usually, the referring physician or health care provider will share the results with you. In some cases, the radiologist may discuss results with you at the conclusion of your examination.

Follow-up examinations may be necessary. Your doctor will explain the exact reason why another exam is requested. Sometimes a follow-up exam is done because a potential abnormality needs further evaluation with additional views or a special imaging technique. A follow-up examination may also be necessary so that any change in a known abnormality can be monitored over time. Follow-up examinations are sometimes the best way to see if treatment is working or if a finding is stable or changed over time.

## What are the benefits vs. risks?

### Benefits

- Most ultrasound scanning is noninvasive (no needles or injections).
- Occasionally, an ultrasound exam may be temporarily uncomfortable, but it should not be painful.
- Ultrasound is widely available, easy-to-use and less expensive than other imaging methods.
- Ultrasound imaging is extremely safe and does not use any ionizing radiation.
- Ultrasound scanning gives a clear picture of soft tissues that do not show up well on x-ray images.
- Ultrasound provides real-time imaging, making it a good tool for guiding minimally invasive procedures such as needle biopsies and fluid aspiration.
- 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 alone.
- Using ultrasound, physicians are able to determine that many areas of clinical 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 turn out to be non-cancerous (false positives).

## 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.
- Many cancers are not visible on ultrasound. Many calcifications seen on mammography cannot be seen on ultrasound. Some early breast cancers only show up as calcifications on mammography.

MRI findings that are due to cancer are not always seen with ultrasound.

- Biopsy may be recommended to determine if a suspicious abnormality is cancer or not.
- Most suspicious findings on ultrasound that require biopsy are not cancers.
- Many facilities do not offer ultrasound screening, even in women with dense breasts, 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 as it is a "real-time" examination. 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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