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Magnetic Resonance (MRI)-Guided Breast Biopsy

Magnetic resonance- or MR-guided breast biopsy uses a powerful magnetic field, radio waves and a computer to help locate a breast lump or abnormality and guide a needle to remove a tissue sample for examination under a microscope. It does not use ionizing radiation and leaves little to no scarring.

Tell your doctor about any health problems, recent surgeries and whether there's a possibility you are pregnant. The magnetic field is not harmful, but it may cause some medical devices to malfunction. Most orthopedic implants pose no risk, but you should always tell the technologist if you have any devices or metal in your body. Guidelines about eating and drinking before your exam vary between facilities. Unless you are told otherwise, take your regular medications as usual. Tell your doctor about any medications you're taking, including aspirin and herbal supplements, and whether you have any allergies – especially to anesthesia. You will be advised to stop taking aspirin or blood thinner three days before your procedure. Wear loose, comfortable clothing and leave jewelry at home. You may be asked to wear a gown. If you are to be sedated, plan to have someone drive you home afterward.

What is MR-Guided Breast Biopsy?

Lumps or abnormalities in the breast are often detected by physical examination, mammography, or other imaging studies. However, it is not always possible to tell from these imaging tests whether a growth is benign or cancerous.

A breast biopsy is performed to remove some cells from a suspicious area in the breast and examine them under a microscope to determine a diagnosis. This can be performed surgically or, more commonly, by a radiologist using a less invasive procedure that involves a hollow needle and image-guidance. Image-guided needle biopsy is not designed to remove the entire lesion but to obtain a small sample of the abnormality for further analysis.

Image-guided biopsy is performed by taking samples of an abnormality under some form of guidance such as ultrasound, MRI or mammography.

In MRI-guided breast biopsy, magnetic resonance imaging is used to help guide the radiologist's instruments to the site of the abnormal growth.

What are some common uses of the procedure?

An MRI-guided breast biopsy is most helpful when MR imaging shows a breast abnormality such as:

- a suspicious mass not identified by other imaging techniques
- an area of distortion
- an area of abnormal tissue change

MRI guidance is used in four biopsy procedures:

- fine needle aspiration (FNA), which uses a very small needle to extract fluid or cells from the abnormal area.
- core needle (CN) which uses a large hollow needle to remove one sample of breast tissue per insertion.
- vacuum-assisted device (VAD) which uses a vacuum powered instrument to collect multiple tissue samples during one needle insertion.
- wire localization, in which a guide wire is placed into the suspicious area to help the surgeon locate the lesion for surgical biopsy.

How should I prepare?

You may be asked to wear a gown during the exam or you may be allowed to wear your own clothing if it is loose-fitting and has no metal fasteners.

Guidelines about eating and drinking before an MRI exam vary with the specific exam and with the imaging facility. Unless you are told otherwise, you may follow your regular daily routine and take food and medications as usual.

Some MRI examinations may require you to receive an injection of contrast material into the bloodstream. The radiologist, technologist or a nurse may ask if you have allergies of any kind, such as an allergy to iodine or x-ray contrast material, drugs, food, or the environment, or if you have asthma. The contrast material most commonly used for an MRI exam contains a metal called gadolinium. Gadolinium can be used in patients with iodine contrast allergy. It is far less common for a patient to have an allergy to a gadolinium-based contrast agent used for MRI than the iodine-containing contrast for CT. However, even if it is known that the patient has an allergy to the gadolinium contrast, it may still be possible to use it after appropriate pre-medication. Patient consent will be requested in this instance. For more information on adverse reactions to gadolinium-based contrast agents, please consult the ACR Manual on Contrast Media.

You should also let the radiologist know if you have any serious health problems, or if you have had any recent surgeries. Some conditions, such as severe kidney disease, may prevent you from being given

gadolinium contrast for an MRI. If you have a history of kidney disease or liver transplant, it will be necessary to perform a blood test to determine whether the kidneys are functioning adequately.

Women should always inform their physician or technologist if there is any possibility that they are pregnant. MRI has been used for scanning patients since the 1980s with no reports of any ill effects on pregnant women or their unborn babies. However, because the unborn baby will be in a strong magnetic field, pregnant women should not have this exam in the first three to four months of pregnancy unless the potential benefit from the MRI exam is assumed to outweigh the potential risks. Pregnant women should not receive injections of gadolinium contrast material except when absolutely necessary for medical treatment. See the MRI Safety page for more information about pregnancy and MRI.

Prior to a needle biopsy, you should report to your doctor all medications that you are taking, including herbal supplements, and if you have any allergies, especially to anesthesia. Your physician may advise you to stop taking aspirin, blood thinners, or certain herbal supplements three to five days before your procedure to decrease your risk of bleeding.

Also, inform your doctor about recent illnesses or other medical conditions.

You may want to have a relative or friend accompany you and drive you home afterward. This is recommended if you have been sedated.

There are other important guidelines for patients to follow prior to undergoing MR imaging. For a list of these and a review of all preparations that should be made prior to MR imaging, please see MRI of the Breast.

What does the equipment look like?

The traditional MRI unit is a large cylinder-shaped tube surrounded by a circular magnet. You will lie on a moveable examination table that slides into the center of the magnet.

Some MRI units, called short-bore systems, are designed so that the magnet does not completely surround you. Some newer MRI machines have a larger diameter bore which can be more comfortable for larger size patients or patients with claustrophobia. Other MRI machines are open on the sides (open MRI). Open units are especially helpful for examining larger patients or those with claustrophobia. Newer open MRI units provide very high quality images for many types of exams. Older open MRI units may not provide this same image quality. Certain types of exams cannot be performed using open MRI. For more information, consult your radiologist.

The computer workstation that processes the imaging information is located in a separate room from the scanner.

The majority of MRI-guided breast biopsies are currently performed in closed MRI systems with a specially modified exam table. This moveable examination table allows your breasts to hang freely into cushioned openings, which contain wire coils that send and receive radio waves to help create the MR images.

One of four instruments will be used:

- A fine needle attached to a syringe, smaller than needles typically used to draw blood.
- A core needle, also called an automatic, spring-loaded needle, which consists of an inner needle connected to a trough, or shallow receptacle, covered by a sheath and attached to a spring-loaded mechanism.
- A vacuum-assisted device (VAD), a vacuum-powered instrument that uses pressure to pull tissue into the needle.
- A thin guide wire, which is used for a surgical biopsy.

Other sterile equipment involved in this procedure includes syringes, sponges, forceps, scalpels and a specimen cup or microscope slide.

How does the procedure work?

Unlike conventional x-ray examinations and computed tomography (CT) scans, MRI does not utilize ionizing radiation. Instead, radiofrequency pulses re-align hydrogen atoms that naturally exist within the body. This does not cause any chemical changes in the tissues. As the hydrogen atoms return to their usual alignment, they emit different amounts of energy depending on the type of body tissue they are in. The MR scanner captures this energy and creates a picture of the tissues scanned based on this information.

The magnetic field is produced by passing an electric current through wire coils in most MRI units. Other coils, located in the machine and in some cases, placed around the part of the body being imaged, send and receive radio waves, producing signals that are detected by the coils. The electric current does not come in contact with the patient.

A computer then processes the signals and generates a series of images, each of which shows a thin slice of the body. The images can then be studied from different angles by the interpreting radiologist.

Frequently, the differentiation of abnormal (diseased) tissue from normal tissues is better with MRI than with other imaging modalities such as x-ray, CT and ultrasound.

Using MRI guidance to calculate the position of the abnormal tissue and to verify the placement of the needle, the radiologist inserts the biopsy needle through the skin, advances it into the lesion and removes tissue samples. If a surgical biopsy is being performed, MRI may be used to guide a wire into the mass to help the surgeon locate the area for excision.

How is the procedure performed?

Image-guided, minimally invasive procedures such as MR-guided breast biopsies are most often performed by a specially trained breast radiologist.

Breast biopsies are usually done on an outpatient basis.

In most cases, you will lie face down on a moveable exam table and the affected breast will be positioned into an opening in the table.

A nurse or technologist will insert an intravenous (IV) line into a vein in your hand or arm and the contrast material gadolinium will be given intravenously.

Your breast will be gently compressed between two compression plates (similar to those used in a diagnostic MRI exam), one of which is marked with a grid structure. Using computer software, the radiologist measures the position of the lesion with respect to the grid and calculates the position and depth of the needle placement.

A local anesthetic will be injected into the skin and more deeply into the breast to numb it.

A very small nick is made in the skin at the site where the biopsy needle is to be inserted.

The radiologist then inserts the needle, advances it to the location of the abnormality and MR imaging is performed to verify its position. Depending on the type of MRI unit being used, you may remain in place or be moved out of the center or boreof the MRI scanner.

Tissue samples are then removed using one of three methods:

- In a fine needle aspiration, a fine gauge needle and a syringe withdraw fluid or clusters of cells.
- In a core needle biopsy, the automated mechanism is activated, moving the needle forward and filling the needle trough, or shallow receptacle, with 'cores' of breast tissue. The outer sheath instantly moves forward to cut the tissue and keep it in the trough. This process is repeated three to six times.
- With a vacuum-assisted device (VAD), vacuum pressure is used to pull tissue from the breast through the needle into the sampling chamber. Without withdrawing and reinserting the needle, it rotates positions and collects additional samples. Typically, eight to 10 samples of tissue are collected from around the lesion.

After this sampling, the needle will be removed.

If a surgical biopsy is being performed, a wire is inserted into the suspicious area as a guide for the surgeon.

A small marker may be placed at the biopsy site so that it can be located in the future if necessary.

Once the biopsy is complete, pressure will be applied to stop any bleeding and the opening in the skin is covered with a dressing. No sutures are needed.

A mammogram may be performed to confirm that the marker is in the proper position.

This procedure is usually completed within 45 minutes.

What will I experience during and after the procedure?

You will be awake during your biopsy and should have little discomfort. Many women report little pain and no scarring on the breast. However, certain patients, including those with dense breast tissue, or abnormalities near the chest wall or behind the nipple may be more sensitive during the procedure.

Some women find that the major discomfort of the procedure is from lying on their stomach for the length of the procedure, which can be reduced by strategically placed cushions. Some women may also experience neck and/or back pain as the head is turned to the side when the breast is positioned for the biopsy.

When you receive the local anesthetic to numb the skin, you will feel a pin prick from the needle followed by a mild stinging sensation from the local anesthetic. You will likely feel some pressure when the biopsy needle is inserted and during tissue sampling, which is normal.

The area will become numb within a few seconds.

You must remain very still while the imaging and the biopsy are being performed.

As tissue samples are taken, you may hear clicks or buzzing sounds from the sampling instrument. These are normal.

If you experience swelling and bruising following your biopsy, you may be instructed to take an over-the-counter pain reliever and to use a cold pack. Temporary bruising is normal.

You should contact your physician if you experience excessive swelling, bleeding, drainage, redness or heat in the breast.

If a marker is left inside the breast to mark the location of the biopsied lesion, it will cause no pain, disfigurement or harm. Biopsy markers are MRI compatible and will not cause metal detectors to alarm.

You should avoid strenuous activity for at least 24 hours after the biopsy. Your biopsy facility will outline more detailed post-procedure care instructions for you.

Who interprets the results and how do I get them?

A pathologist examines the removed specimen and makes a final diagnosis. Depending on the facility, the radiologist or your referring physician will share the results with you. The radiologist will also evaluate the results of the biopsy to make sure that the pathology and image findings explain one another. In some instances, even if cancer is not diagnosed, surgical removal of the entire biopsy site and imaging abnormality may be recommended if the pathology does not match the imaging findings.

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

- The procedure is less invasive than surgical biopsy, leaves little or no scarring and can be performed in less than an hour.
- MRI is a noninvasive imaging technique that does not involve exposure to ionizing radiation.
- MRI-guided breast biopsy using a core needle is considered both safe and accurate.
- The speed, accuracy and safety of MRI-guided vacuum-assisted breast biopsy are as good as MR-guided wire localization without the associated complications and cost of surgery.
- Compared with stereotactic biopsy, the MRI-guided method avoids the need for ionizing radiation exposure.
- MRI-guided breast biopsy, using either the core needle method or the vacuum-assisted device, takes less time than surgical biopsy, causes less tissue damage, and is less costly.
- Recovery time is brief and patients can soon resume their usual activities.

Risks

- There is a risk of bleeding and forming a hematoma, or a collection of blood at the biopsy site. The risk, however, appears to be less than one percent of patients.
- An occasional patient has significant discomfort, which can be readily controlled by non-prescription pain medication.
- Any procedure where the skin is penetrated carries a risk of infection. The chance of infection requiring antibiotic treatment appears to be less than one in 1,000.
- Depending on the type of biopsy being performed or the design of the biopsy machine, a biopsy of tissue located deep within the breast carries a slight risk that the needle will pass through the chest wall, allowing air around the lung that could cause the lung to collapse. This is an extremely rare occurrence.
- There is a small chance that this procedure will not provide the final answer to explain the imaging abnormality.
- Manufacturers of intravenous contrast indicate mothers should not breastfeed their babies for 24-48 hours after contrast medium is given. However, both the American College of Radiology (ACR) and the European Society of Urogenital Radiology note that the available data suggest that it is safe to continue breastfeeding after receiving intravenous contrast. For further information please consult the ACR Manual on Contrast Media and its references.

What are the limitations of MRI-Guided Breast Biopsy?

MRI-guided tissue sampling is limited by the position of the abnormality in the breast. Breast lesions located in the back of the breast or small abnormalities can be difficult or impossible to accurately target using MR.

Breast biopsy procedures will occasionally miss a lesion or underestimate the extent of disease present. If the diagnosis remains uncertain after a technically successful procedure, surgical biopsy will usually be necessary.

The MR-guided breast biopsy method cannot be used unless the mass can be seen on an MRI exam. Calcifications within a cancerous nodule are not shown as clearly with MR as with x-rays. Small lesions

may be difficult to target accurately by MR-guided breast biopsy.

The widespread use of this technique is limited by its high cost, availability, and length of the procedure. MR-guided biopsy should not be considered if the lesion can be seen on mammography or on ultrasound, where the biopsy can be performed more easily with less patient discomfort. In those cases, stereotactic biopsy or ultrasound-guided biopsy are the more appropriate methods of tissue sampling.

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