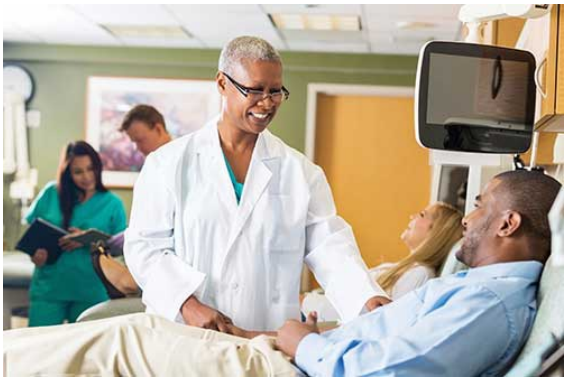
Ultrasound- or MRI-Guided Prostate Biopsy



Prostate biopsy uses ultrasound or magnetic resonance imaging (MRI) guidance and a needle to remove tissue samples for lab analysis. The ultrasound probe used in prostate biopsies is about the size of a finger. The doctor inserts the probe into the rectum and collects tissue samples using a spring-driven needle core biopsy device. The doctor may perform MRI-guided biopsy from inside the rectum (endorectal (http://www.radiologyinfo.org)) or through the perineum (http://www.radiologyinfo.org) (transperineal). Biopsy is currently the only way to confirm a diagnosis of prostate cancer. Doctors also use it to tell the difference between cancer and an enlarged prostate (https://www.radiologyinfo.org/en/info/bph) , a common condition in older men.

Your doctor will tell you how to prepare based on the type of biopsy you will undergo. Tell your doctor about all the medications you take, including aspirin and herbal supplements. List any allergies – especially to anesthesia. Your doctor will tell you to stop taking aspirin or blood thinners seven to 10 days before your biopsy. You may need to eat light meals before your procedure and clear your bowel with an enema (http://www.radiologyinfo.org) . Leave jewelry at home and wear loose, comfortable clothing. You may need to change into a gown for the procedure.

What is Ultrasound- and MRI-guided Prostate Biopsy?

Doctors use ultrasound- and MRI-guided biopsy to collect tissue samples from the prostate gland (http://www.radiologyinfo.org) . A pathologist (http://www.radiologyinfo.org) examines the samples and determines whether or not cancer is present.

Doctors most commonly perform biopsies (http://www.radiologyinfo.org) using ultrasound guidance. The doctor inserts a special biopsy needle into the prostate through the wall of the rectum to remove several small samples of tissue for lab analysis. This is known as transrectal ultrasound (TRUS) guided biopsy.

The doctor may also access the prostate through the perineum (transperineal). Your doctor may use this approach:

- if cancer is suspected at the front of the prostate gland too far away from the rectum for TRUS
- if transrectal ultrasound is not feasible due to prior rectal surgery
- for some mapping biopsies
- by doctor's choice

Your doctor can also biopsy the prostate using magnetic resonance imaging (MRI) or Mp-MRI (multiparametric MRI). MRI and Mp-MRI provide more detailed images of the prostate than ultrasound can. Mp-MRI is an advanced imaging method that combines three MRI techniques to provide information on the structure and function of the prostate.

Before the biopsy, the doctor will examine the MR images, sometimes with the help of computer-aided detection (http://www.radiologyinfo.org) (CAD) software. This will pinpoint specific areas that may require further evaluation. The doctor may perform MRI-guided in-bore biopsy using either a transperineal or transrectal approach. Both methods typically use software to guide the needle to the desired position within the prostate.

Finally, the doctor may use MRI/TRUS fusion. This method fuses MR images with real-time ultrasound images. It combines the superior image quality of MRI with easy-to-use ultrasound. Your doctor may perform MRI/TRUS in the office setting.

What are some common uses of the procedure?

Biopsy is currently the only way to confirm a diagnosis of prostate cancer. Doctors also use it to tell the difference between cancer and benign prostatic hyperplasia (http://www.radiologyinfo.org) or nodular enlargement of the prostate. BPH (enlarged prostate) is very common among older men. It requires a different treatment approach than that of cancer.

The doctor may order a biopsy if they detect a nodule or other abnormality during a digital rectal examination (http://www.radiologyinfo.org) (DRE) to screen for prostate cancer.

The doctor may also order a biopsy when a blood test reveals elevated levels of prostate-specific antigen (http://www.radiologyinfo.org) (PSA). There are several reasons why you may have an elevated PSA level. However, higher PSA levels are sometimes associated with the presence of cancer.

Your doctor will typically use TRUS to perform a prostate biopsy. When patients with a rising PSA level undergo an ultrasound-guided biopsy but no cancer is detected, the doctor may use MRI- and Mp-MRI-guided prostate biopsy.

The doctor may also use MRI- and Mp-MRI-guided prostate biopsy when they cannot use ultrasound to easily target a very small abnormality identified on MRI.

A biopsy not only detects cancer; it also provides information on how aggressive it is. It also helps to guide treatment decisions.

How should I prepare?

Prior to a prostate biopsy, tell your doctor about all the medications you take, including herbal supplements. List any allergies (especially to anesthesia), recent illnesses, and other medical conditions.

You may need to stop taking blood thinners for seven to 10 days before the procedure. This will help prevent excessive bleeding during and after the biopsy. The doctor may check your blood clotting on the day of the procedure. Ask your doctor and the hospital radiology clinic or department for more information.

You may need to take oral antibiotics a day before and the morning of the biopsy. This will help prevent infection.

If you are having an MRI-guided biopsy, you will need to wear metal-free clothing and remove any metallic objects, such as jewelry, watches, and hearing aids.

A technologist will walk through an MR imaging safety checklist with you. Tell your technologist about prior surgeries and metal implants, such as pacemakers, aneurysm clips, and joint replacements.

An MRI-guided procedure may use an injection of gadolinium contrast material. Because gadolinium does not contain iodine, it can be used safely in patients with contrast allergies.

Your MRI procedure may use an endorectal coil (http://www.radiologyinfo.org) . This is a thin wire covered with a latex balloon. The doctor will lubricate this assembly and gently insert it into your rectum. Tell the doctor if you are allergic to latex so they may cover the coil with a latex-free balloon.

Eat light meals on the day prior to and the day of your biopsy. This will help make it easier to insert the ultrasound probe or endorectal coil. You may need to use an enema (http://www.radiologyinfo.org) to help clear your bowel. Enema kits and saline laxatives are available over the counter.

Tell your doctor if you have any serious health problems or recent surgeries. Some conditions, such as severe kidney disease, may prevent you from receiving gadolinium for an MR exam. If you have a history of kidney disease, your doctor may do a blood test to check your kidney function.

You may receive sedation for the procedure. If so, have someone accompany you and drive you home afterward.

What does the equipment look like?

Ultrasound equipment:

Ultrasound scanners consist of an electronic console containing a computer, video monitor, and a handheld transducer (probe). The transducer sends out inaudible high frequency sound waves into the body and listens for the returning echoes. The principle is similar to the sonar used by boats and submarines.

The computer displays the ultrasound image on a video monitor. This image is based on the amplitude (loudness) and frequency (pitch) of the signal. It is also based on signal travel time, tissue composition, and the type of body structure through which the sound travels.

The ultrasound probe for a prostate biopsy is about the size of a finger. Once the doctor inserts the probe into the rectum, they take tissue samples using a spring-driven needle core biopsy device (biopsy gun). The handheld device includes a long but very thin needle. The needle opens inside the prostate, takes the sample, and then closes.

MRI equipment:

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

Some MRI units, called short-bore systems (http://www.radiologyinfo.org) , 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 patients or those with claustrophobia. "Open" MRI units are open on the sides. They are especially helpful for examining larger patients or those with claustrophobia. Open MRI units can provide high quality images for many types of exams. Open MRI may not be used for certain exams. For more information, consult your radiologist.

The doctor may perform MRI- or Mp-MRI-guided biopsy from inside the rectum (endorectal (http://www.radiologyinfo.org)) or through the perineum (http://www.radiologyinfo.org) (transperineal). For the endorectal biopsy, the patient usually lies on his stomach. The biopsy device has a built in endorectal coil to aid in visualization and a guidance slot for inserting the biopsy needle. For the transperineal biopsy, the patient usually lies on his back. The doctor places a guidance grid against the perineum and selects the appropriate path for the biopsy needle. Both MR biopsy techniques use software to fuse the biopsy needle guides with the MR images to obtain more accurate needle placement.

How does the procedure work?

Ultrasound procedure:

Ultrasound imaging uses the same principles as the sonar that bats, ships, and fishermen use. 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 its size, shape, and consistency. This includes whether the object is solid or filled with fluid.

Doctors use ultrasound to detect changes in the appearance of organs, tissues, and vessels and to detect abnormal masses, such as tumors.

In an ultrasound exam, a transducer (http://www.radiologyinfo.org) both sends the sound waves and records the echoing

(returning) waves. When the transducer is pressed against the skin, it sends 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. A computer instantly measures these signature waves and displays them as real-time pictures on a monitor. The technologist typically captures one or more frames of the moving pictures as still images. They may also save short video loops of the images.

MRI procedure:

Unlike x-ray and computed tomography (CT) exams, MRI does not use radiation. Instead, radio waves 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 tissue they are in. The scanner captures this energy and creates a picture using this information.

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

A computer processes the signals and creates a series of images, each of which shows a thin slice of the body. The radiologist can study these images from different angles.

MRI is often able to tell the difference between diseased tissue and normal tissue better than x-ray, CT, and ultrasound.

In MRI-guided prostate biopsy, an endorectal coil helps provide more detailed images of the prostate and surrounding structures. It also enables your radiologist to perform MR spectroscopy (http://www.radiologyinfo.org) . MR spectroscopy can provide more information on the chemical makeup of the cells within the prostate. Mp-MRI can measure the motion of water molecules (water diffusion) and blood flow (perfusion imaging) within the prostate. This helps the doctor tell the difference between diseased tissue and normal prostate tissue.

How is the biopsy procedure performed?

Ultrasound-guided biopsy procedure:

A radiologist or urologist will perform an ultrasound-guided prostate biopsy. A sonographer and a nurse will assist.

You may need a small enema about half an hour before the biopsy to clear out your bowel and rectum. This allows the doctor to see the prostate more clearly, and it helps lower the risk of infection.

You may also receive antibiotics just before the biopsy as an additional safeguard against infection. Your doctor may provide medication for pain and anxiety. Sometimes the doctor will use a local anesthetic injection or sedative to minimize discomfort during the procedure.

This procedure often uses a light general anesthetic, which means you will be asleep or sedated during the biopsy. If the biopsy uses anesthesia, an anesthesiologist will be present.

You will lie on your left side with your legs bent for the procedure.

The doctor will first carry out a digital rectal exam (DRE) with a gloved finger.

The doctor will insert a sterilized ultrasound probe insert into your rectum. They will cover the probe with a condom to protect against infection or contamination. The doctor will lubricate it to help it glide easily into your rectum.

After examining your prostate with ultrasound, the doctor will perform the biopsy. Ultrasound images guide the doctor in

placing a very fine needle through the wall of your rectum. Once the needle is within the prostate, the doctor will take a tissue sample. With continuous ultrasound imaging, the doctor can view the biopsy needle as it advances to the prostate in real time.

The doctor will repeat the biopsy sampling to ensure coverage of the visible abnormal area. Many times, the doctor will take tissue samples from normal-appearing areas to ensure no cancer is hiding there. Usually, the doctor will take between six and 14 individual samples during the ultrasound-guided procedure. These samples are sent to a pathologist for lab analysis.

After taking the tissue samples, the doctor removes the probe. If you had a general anesthetic, they will wake you. The doctor will give you a small pad to wear in case of any bleeding. You will be kept under observation until they are satisfied with your condition.

The entire ultrasound-guided biopsy procedure usually takes 45 minutes or less.

MRI-guided biopsy procedure:

A radiologist will perform the MRI-guided biopsy with the assistance of a nurse and an MRI technologist. As with the ultrasound procedure, you may receive antibiotics, sedatives, and pain medication before the biopsy.

The MRI-guided procedure may use contrast material. A nurse or technologist will insert an intravenous (IV) catheter into a vein in your hand or arm. If you're having an MRI-guided transrectal biopsy, you will lie face-down on a cushioned table. The doctor gently inserts the biopsy guide into the rectum. Using imaging guidance, the doctor guides the biopsy needle into position and takes a tissue sample. If you're having an MRI-guided transperineal biopsy, you will lie on your back. The doctor will place a guidance grid between your legs. Using imaging guidance, the doctor will advance the biopsy needle through the grid into the targeted prostate tissue. MRI-guided biopsies may require two to 14 biopsy samples. The number of samples will depend on whether the doctor is focusing on one area or performing a mapping biopsy. MRI-guided prostate biopsy takes 30 to 90 minutes, with post-procedure monitoring for 45 to 60 minutes.

The doctor may use MRI and Mp-MRI images during an ultrasound-guided prostate biopsy. For this procedure, the MR images are fused to real-time ultrasound (US) imaging to help target biopsy sites. A urologist will usually perform MRI/US fusion biopsy in an outpatient clinic setting. The doctor uses MRI and MRI/US targeted biopsies when an initial ultrasound-guided biopsy does not identify cancer but there is continued concern about its possible presence.

What will I experience during and after the biopsy?

If you receive IV contrast for the MRI-guided procedure, you may feel coolness and a flushing sensation for a minute or two following the injection. The IV needle may cause some discomfort when the doctor inserts it and you may have some bruising when they remove it.

Rarely, patients may experience side effects from MR contrast material, such as nausea and local pain, hives, itchy eyes, or other reactions. If you have allergic symptoms, a radiologist or other doctor will be available for immediate assistance.

When the doctor inserts the ultrasound probe or endorectal coil into the rectum, you will feel pressure and may have some temporary discomfort.

You will hear a clicking noise when the biopsy needle samples the prostate and you may feel a stinging or burning sensation in the area.

Some patients find it uncomfortable to remain still during an MRI. Others experience a sense of being closed-in (claustrophobia). Sedation is available for patients who anticipate anxiety.

If you feel heating on your skin at any time during MR imaging, tell the MR technician so they can closely examine the area.

Some patients experience a small amount of bleeding from the rectum or perineum immediately after the biopsy. If this does occur, it will cease with gentle pressure.

If you did not receive sedation, no recovery period is necessary. Light general anesthetic or sedation may leave you feeling groggy for a day or so.

You may feel pain and discomfort in the area for a day or two, particularly when you are sitting down.

Who interprets the results and how do I get them?

A pathologist examines the tissue samples and makes a final diagnosis. Biopsy results usually are available to your doctor a few days after the procedure. The time it takes may vary based on the complexity of the exam, specimen prep time, need for a second opinion, and other factors.

What are the benefits vs. risks?

Benefits

- Ultrasound- and MRI-guided prostate biopsies help accurately diagnose abnormalities in the prostate and speed the start of appropriate treatment.
- Biopsies help distinguish between cancer and BPH (http://www.radiologyinfo.org) .
- Ultrasound is widely available, easy-to-use, and less expensive than other imaging methods.
- Ultrasound and MR imaging do not use radiation. Excessive amounts of radiation are associated with an increased risk of cancer.
- Recovery time for both procedures is brief and patients can soon resume their usual activities.
- MR images of the prostate are clearer and more detailed than other imaging methods. This makes it a valuable tool in early diagnosis and evaluation of the extent of tumors.
- Using Mp-MRI images, doctors can:
    - reduce the number of needle insertions
    - eliminate unnecessary prostate biopsies
    - improve the detection of clinically important prostate cancer while reducing overdiagnoses of clinically unimportant prostate cancer
    - determine how aggressive the prostate cancer is, whether it has spread outside the prostate, and where it may have spread.

Risks

- Blood in the semen and urine is common after the procedure but usually goes away within a week or two.
- Blood in the feces is common in the days after the procedure.
- Infection is very rare but can be severe if left untreated. If you have signs of infection such as fever and chills within a few days of the procedure, call your doctor immediately or go to the nearest hospital emergency department.
- While internal bleeding is very rare, it may require treatment if it is severe.
- Rarely, men may be temporarily unable to pass urine. This can occur due to blockage of the urethra (http://www.radiologyinfo.org) . Your doctor will insert a catheter (http://www.radiologyinfo.org) into the urethra to relieve the blockage.
- Implanted medical devices that contain metal may malfunction or cause problems during MR imaging.
- If the biopsy uses contrast material, there is a very slight risk of allergic reaction. Such reactions usually are mild and easily controlled by medication. If you have allergic symptoms, a radiologist or other doctor will be available for immediate

assistance.

- Nephrogenic systemic fibrosis is a very rare complication of MRI with gadolinium. Doctors believe it to be caused by the injection of high doses of gadolinium contrast material in patients with very poor kidney function. If you have poor kidney function, you may not be a candidate for gadolinium contrast.

What are the limitations of Ultrasound-and MRI-guided Prostate Biopsy?

A biopsy can only show if there is cancer in the tissue samples. It is possible to miss cancer in unsampled areas of the prostate.

For MRI-guided biopsies, you must remain perfectly still to ensure the technologist captures high-quality images. If you are anxious, confused, or in severe pain, it may be hard to lie still. If so, the images may not be of high enough quality to be useful.

Likewise, the presence of an implant or other metallic object sometimes makes it difficult to obtain clear MR images. A person who is very large may not fit inside certain types of MRI machines.

Bleeding may sometimes occur in the prostate after a biopsy. MR imaging cannot always tell the difference between cancer, inflammation, or the presence of blood. To avoid confusing them, your doctor may perform a repeat MRI six to eight weeks after the biopsy to allow residual bleeding to resolve.

An MRI exam typically costs more and may take more time than other imaging exams. Talk to your insurance provider if you have concerns about the cost of MRI.

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