

## Ultrasound Imaging of the Pelvis

*This information 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.*

### What is Ultrasound Imaging of the Pelvis?

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 (as used in x-rays). 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. A pelvic ultrasound provides pictures of the structures and organs in the lower abdomen or pelvis.

There are three types of pelvic ultrasound:

- abdominal (transabdominal)
- vaginal (transvaginal, endovaginal) for women
- rectal (transrectal) for men

A Doppler ultrasound exam may be part of a pelvic ultrasound examination.

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

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

In women, a pelvic or abdominal ultrasound is most often performed to evaluate the:

- bladder.
- ovaries.
- uterus.
- cervix.
- fallopian tubes.

Pelvic ultrasound exams are also used to monitor the health and development of an embryo or fetus during pregnancy.

Ultrasound examinations can help diagnose symptoms experienced by women such as:

- pelvic pain
- abnormal bleeding
- other menstrual problems

and help identify:

- palpable masses such as ovarian cysts and uterine fibroids
- ovarian or uterine cancers

A transvaginal ultrasound is usually performed to view the endometrium, or the lining of the uterus, including its thickness, and ovaries. Transvaginal ultrasound also affords a good way to evaluate the muscular walls of the uterus, called the myometrium. Sonohysterography allows for a more in-depth investigation of uterine cavity. These exams are typically performed to detect:

- uterine anomalies
- scars
- endometrial polyps
- fibroids
- cancer, especially in patients with abnormal uterine bleeding

Some physicians also use sonohysterography for patients with infertility.

In men, a pelvic or abdominal ultrasound is used to evaluate the:

- bladder.
- seminal vesicles.
- prostate.

The transrectal ultrasound, a special study usually done to view the prostate gland, involves inserting a specialized transducer into a man's rectum.

In men and women, a pelvic ultrasound exam can help identify:

- kidney stones.
- tumors.
- other disorders in the urinary bladder.

Pelvic ultrasound is also used to guide procedures such as needle biopsies, in which needles are used to extract a sample of cells from organs for laboratory testing

Doppler ultrasound images can help the physician to see and evaluate:

- blockages to blood flow (such as clots).
- narrowing of vessels (which may be caused by plaque).
- tumors and congenital malformation.

## How should I prepare?

You should wear comfortable, loose-fitting clothing for your ultrasound exam. You may need to remove all clothing and jewelry in the area to be examined.

You may be asked to wear a gown during the procedure.

A full bladder helps to visualize the uterus, ovaries, bladder wall and prostate gland for transabdominal ultrasound.

## 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 and blood vessels. The transducer is a small hand-held device that resembles a microphone, attached to the scanner by a cord. The transducer sends out high frequency sound waves 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.

For ultrasound procedures requiring insertion of the transducer, such as transvaginal or transrectal exams, the device is covered and lubricated.

## 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 and its size, shape, and consistency (whether the object is solid, filled with fluid, or both).

In medicine, ultrasound is used to detect changes in appearance of organs, tissues, and vessels or detect 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 small pulses 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. One or more frames of the moving pictures are typically captured as still images.

The same principles apply to ultrasound procedures such as transrectal and transvaginal which require insertion of a special transducer into the body.

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?

For most ultrasound exams, the patient is positioned lying face-up on an examination table that can be tilted or moved.

A clear water-based 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 over the area of interest.

### Transvaginal:



Transvaginal ultrasound is performed very much like a gynecologic exam and involves the insertion of the transducer into the vagina after the patient empties her bladder. The tip of the transducer is smaller than the standard speculum used when performing a Pap test. A protective cover is placed over the transducer, lubricated with a small amount of gel, and then inserted into the vagina. Only two to three inches of the transducer end are inserted into the vagina. The images are obtained from different orientations to get the best views of the uterus and ovaries.

Transvaginal ultrasound is usually performed with the patient lying on her back with her feet in stirrups similar to a gynecologic exam.

### Transrectal:



For a transrectal ultrasound, a protective cover is placed over the transducer, it is lubricated, and then placed into the rectum.

The patient usually lies on his or her side, facing away from the examiner, with the knees and hips slightly flexed.

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.

These ultrasound examinations are usually completed within 30 minutes.

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

Most ultrasound examinations are painless, fast and easy.

For a transabdominal exam:

After you are positioned on the examination table, the radiologist or sonographer will apply some warm water-based gel on your skin and then place the transducer firmly against your body, moving it 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.

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

Ultrasound exams in which the transducer is inserted into an opening of the body may produce minimal discomfort.

For a transvaginal exam:

With transvaginal ultrasound, although the examination is often performed to look for a cause of pelvic pain, the sonogram itself should not be painful or significantly increase your discomfort. A vaginal sonogram is usually more comfortable than a manual gynecologic examination.

For a transrectal exam:

If no biopsy is required, transrectal ultrasound of the prostate is similar or may have less discomfort than a rectal exam performed by your doctor.

If a biopsy is performed, additional discomfort, due to the needle insertion, is usually minimal because the rectal wall is relatively insensitive to the pain in the region of the prostate. A biopsy will add time to the procedure.

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

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 within a few hours.

## 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 the physician who referred you for the exam, who will share the results with you. In some cases the radiologist may discuss results with you at the conclusion of your examination.

## What are the benefits vs. risks?

### Benefits

- Most 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.
- Ultrasound is the preferred imaging modality for the diagnosis and monitoring of pregnant women and their unborn babies.
- Ultrasound provides real-time imaging, making it a good tool for guiding minimally invasive procedures such as needle biopsies and needle aspiration.
- Pelvic ultrasound can help to identify and evaluate a variety of urinary and reproductive system disorders in both sexes without even the minimal risks associated with x-ray exposure.

### Risks

- For standard diagnostic ultrasound there are no known harmful effects on humans.

## What are the limitations of Pelvic Ultrasound Imaging?

Ultrasound waves are disrupted by air or gas; therefore ultrasound is not an ideal imaging technique for the bowel or organs obscured by the bowel. In most cases, barium exams, CT scanning, and MRI are the methods of choice in this setting. Large patients are more difficult to image because tissue attenuates (weakens) the sound waves as they pass deeper into the body.

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