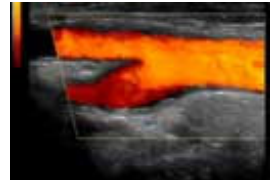


## Ultrasound - Vascular

### What is Vascular Ultrasound?

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.

Vascular ultrasound provides pictures of the body's veins and arteries.

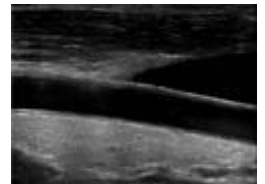
A Doppler ultrasound study may be part of a vascular ultrasound examination.

Doppler ultrasound is a special ultrasound technique that evaluates blood flow 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?

Sonography is a useful way of evaluating the body's circulatory system. Vascular ultrasound is performed to:

- help monitor the blood flow to organs and tissues throughout the body.
- locate and identify blockages (stenosis) and abnormalities like plaque or emboli and help plan for their effective treatment.
- detect blood clots (deep venous thrombosis (DVT) in the legs or arms.
- determine whether a patient is a good candidate for a procedure such as angioplasty.
- evaluate the success of procedures that graft or bypass blood vessels.
- determine if there is an enlarged artery (aneurysm).
- determine the source and severity of varicose veins.



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.

If your abdominal vessels are being examined, unless the examination is performed on an urgent basis, it is often best to fast before the procedure.

Ultrasound exams are very sensitive to motion and an active or crying child will slow the exam process. To ensure a smooth experience, it would be beneficial to explain the procedure to the child prior to the exam. You may bring a book to read to the child to ease anxiety. Ultrasound departments often have a television in the examination room and the child's favorite show may be played if there are no other available distractions.

## What does the equipment look like?

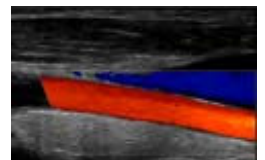
Ultrasound scanners consist of a console containing a computer and electronics, a video display screen and a transducer that is used to scan the body and blood vessels. The transducer is a small hand-held device that resembles a microphone, attached to the scanner by a cord. The transducer sends out 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.

The ultrasound image is immediately visible on a nearby video display 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 and the type of body structure the sound travels through.



## 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).

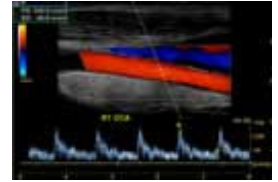


In medicine, ultrasound is used to detect changes in appearance of organs, tissues, and vessels or detect abnormal masses, such as tumors.

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.

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?

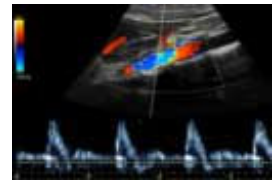
For most ultrasound exams, the patient is positioned lying face-up on an examination table that can be tilted or moved.

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 in various locations, sweeping over the area of interest or angling the sound beam from a farther location to better see an area of concern.



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 to 45 minutes. Occasionally, complex examinations may take longer.

## 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 apply some warm water-based gel on your skin and then place the transducer firmly against your body, moving it 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.

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

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.

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 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 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 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.

### Risks

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

## What are the limitations of Vascular Ultrasound?

- Vessels deep in the body are harder to see than superficial vessels. Specialized equipment or other tests such as CT or MRI may be necessary to properly visualize them.
- Smaller vessels are more difficult to image and evaluate than larger vessels.
- Calcifications that occur as a result of atherosclerosis may obstruct the ultrasound beam.
- Sometimes ultrasound cannot differentiate between a blood vessel that is closed versus one that is nearly closed. Even if there is a very small remaining opening, the weak blood flow produces a sometimes undetectable signal.
- The test is specialized and is best performed by a technologist and physician with experience and interest in vascular ultrasound imaging.

## Additional Information and Resources

American Stroke Association: <http://www.strokeassociation.org>

National Stroke Association: <http://www.stroke.org>

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