

## Venous Ultrasound

Venous ultrasound uses sound waves to produce images of the veins in the body. It is commonly used to search for blood clots, especially in the veins of the leg – a condition often referred to as deep vein thrombosis. Ultrasound does not use ionizing radiation and has no known harmful effects.

On occasion, you may be asked not to eat or drink anything but water for six to eight hours beforehand. Otherwise, little or no special preparation is required for this procedure. Leave jewelry at home and wear loose, comfortable clothing. You may be asked to wear a gown.



### What is Venous Ultrasound Imaging?

Ultrasound imaging is a noninvasive medical test that helps physicians diagnose and treat medical conditions. It is safe and painless. It produces pictures of the inside of the body using sound waves. Ultrasound imaging is also called sonography (<http://www.radiologyinfo.org>). It uses a small probe called a transducer and gel placed directly on the skin. High-frequency sound waves travel from the probe through the gel into the body. The probe collects the sounds that bounce back. A computer uses those sound waves to create an image. Ultrasound exams do not use radiation (<http://www.radiologyinfo.org>) (x-rays (<http://www.radiologyinfo.org>)). Because ultrasound captures images in real-time, it can show the structure and movement of the body's internal organs. The images can also show blood flowing through blood vessels.

Venous ultrasound provides pictures of the veins throughout the body.

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

Doppler ultrasound (<http://www.radiologyinfo.org>) is a special ultrasound technique that evaluates movement of materials in the body. It allows the doctor to see and evaluate blood flow through arteries and veins in the body.

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

The most common reason for a venous ultrasound exam is to search for blood clots (<http://www.radiologyinfo.org>), especially in the veins of the leg. This condition is often referred to as deep vein thrombosis (<http://www.radiologyinfo.org>) or DVT. These clots may break off and pass into the lungs, where they can cause a dangerous condition called pulmonary embolism (<http://www.radiologyinfo.org>). If the blood clot in the leg is found early enough, treatment can be started to prevent it from passing to the lung.

A venous ultrasound study is also performed to:

- determine the cause of long-standing leg swelling. In people with a common condition called "varicose veins", the valves that normally keep blood flowing back to the heart may be damaged, and venous ultrasound can help identify the damaged valves and abnormal blood flow.
- aid in guiding placement of a needle or catheter (<http://www.radiologyinfo.org>) into a vein. Sonography can help locate the exact site of the vein and avoid complications, such as bleeding or damage to a nearby nerve or artery.
- map out the veins in the leg or arm so that pieces of vein may be removed and used to bypass a narrowed or blocked blood

vessel. An example is using portions of vein from the leg to surgically bypass narrowed heart (coronary (<http://www.radiologyinfo.org>) ) arteries.

- examine a blood vessel graft used for dialysis (<http://www.radiologyinfo.org>) if it is not working as expected; for example, the graft may be narrowed or blocked.

In children, venous ultrasound is used to:

- evaluate a connection between an artery and a vein which can be seen in congenital vascular malformations (arteriovenous malformations or fistula) and in dialysis fistula.

If a line is placed in a vein of the legs or arms, there is a much higher chance of developing a clot around it due to the smaller vessel size (especially in infants and young children). In some instances, a clot can suddenly form in the arm due to compression of the vein at the inlet of the chest or in the left leg due to compression of the vein on the left side by an artery in the abdomen.

Doppler ultrasound helps the doctor to see and evaluate:

- blockages to blood flow (such as clots)
- narrowing of vessels
- tumors and congenital vascular malformations
- reduced or absent blood flow to various organs, such as the testes or ovary
- increased blood flow, which may be a sign of infection

## How should I prepare?

Wear comfortable, loose-fitting clothing. You may need to remove all clothing and jewelry in the area to be examined.

You may need to change into a gown for the procedure.

A period of fasting is necessary only if you are to have an examination of veins in your abdomen. In this case, you will probably be asked not to ingest any food or fluids except water for six to eight hours ahead of time. Otherwise, there is no other special preparation for a venous ultrasound.

## What does the equipment look like?

Ultrasound machines consist of a computer console, video monitor and an attached transducer (<http://www.radiologyinfo.org>) . The transducer is a small hand-held device that resembles a microphone. Some exams may use different transducers (with different capabilities) during a single exam. The transducer sends out inaudible, high-frequency sound waves into the body and listens for the returning echoes. The same principles apply to sonar used by boats and submarines.

The technologist applies a small amount of gel to the area under examination and places the transducer there. The gel allows sound waves to travel back and forth between the transducer and the area under examination. The ultrasound image is immediately visible on a video monitor. The computer creates the image based on the loudness (amplitude), pitch (frequency), and time it takes for the ultrasound signal to return to the transducer. It also considers what type of body structure and/or tissue the sound is traveling through.

## How does the procedure work?

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.

Doppler ultrasound, a special ultrasound technique, 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, you will lie face-up on an exam table that can be tilted or moved. Patients may turn to either side to improve the quality of the images.

The technologist applies a clear water-based gel to the body area under examination. This helps the transducer make secure contact with the body. It also helps eliminate air pockets between the transducer and the skin that can block the sound waves from passing into your body. The technologist or radiologist places the transducer on the skin in various locations, sweeping over the area of interest. They may also angle the sound beam from a different location to better see an area of concern.

Doctors perform Doppler sonography with the same transducer.

When the exam is complete, the technologist may ask you to dress and wait while they review the ultrasound images.

This ultrasound examination is usually completed within 30 to 45 minutes. More complex exams may take a longer period of time.

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

Most ultrasound exams are painless, fast, and easily tolerated.

After you lie on the exam table, the radiologist (<http://www.radiologyinfo.org>) or sonographer (<http://www.radiologyinfo.org>) will apply some warm, water-based gel on your skin and then place the transducer (<http://www.radiologyinfo.org>) firmly against your body. They will move it back and forth over the area of interest to capture the desired images. There is usually no discomfort from pressure as they press the transducer against the area under examination.

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

If the doctor performs a Doppler ultrasound exam, you may hear pulse-like sounds that change in pitch as they monitor and measure the blood flow.

Once the imaging is complete, the technologist will wipe off the clear ultrasound gel from your skin. Any portions that remain will dry quickly. The ultrasound gel does not usually stain or discolor clothing.

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 doctor trained to supervise and interpret radiology exams, will analyze the images. The radiologist will send a

signed report to the doctor who requested the exam. Your doctor will then share the results with you. In some cases, the radiologist may discuss results with you after the exam.

You may need a follow-up exam. If so, your doctor will explain why. Sometimes a follow-up exam further evaluates a potential issue with more views or a special imaging technique. It may also see if there has been any change in an issue over time. Follow-up exams are often the best way to see if treatment is working or if a problem needs attention.

## 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 most other imaging methods.
- Ultrasound imaging is extremely safe and does not use radiation.
- Ultrasound scanning gives a clear picture of soft tissues that do not show up well on x-ray images.
- Venous ultrasound helps to detect blood clots in the veins of the legs before they become dislodged and pass to the lungs. It can also show the movement of blood within blood vessels.
- Compared to venography (<http://www.radiologyinfo.org>), which requires injecting contrast material into a vein, venous ultrasound is accurate for detecting blood clots in the veins of the thigh down to the knee. In the calf, because the veins become very small, ultrasound is less accurate. However, potentially dangerous venous clots are typically lodged in the larger veins.

### Risks

- Standard diagnostic ultrasound (<http://www.radiologyinfo.org>) has no known harmful effects on humans.

## What are the limitations of Venous Ultrasound Imaging?

Veins lying deep beneath the skin, especially small veins in the calf, may be hard to see.

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