Venous Ultrasound (Extremities)

This procedure 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 Venous Ultrasound Imaging?

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 (x-ray). Because ultrasound images are captured in real-time, they can show the structure and movement of the body's internal organ, as well as blood flowing through blood vessels.

Ultrasound imaging is usually a painless medical test that helps physicians diagnose and treat medical conditions.

Venous ultrasound provides pictures of the veins throughout the body that carry blood back to the heart.

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

Doppler ultrasound is a special ultrasound technique that evaluates blood 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?

The most common reason for a venous ultrasound exam is to search for blood clots, especially in the veins of the leg. This condition is often referred to as deep vein thrombosis or DVT. These clots may break off and pass into the lungs, where they can cause a dangerous condition called pulmonary embolism. If found in time, there are treatments that can prevent this from happening.

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 keep blood flowing in the right direction may not work well, and venous ultrasound can help the surgeon decide how best to deal with this condition.
- aid in the placement of a needle or catheter in a large interior vein. Sonography can help locate the exact site of the vein and avoid complications, such as bleeding or air in the chest cavity.
- map out the veins in the leg or arm so that segments may be removed and used to bypass an area of disease. An example is using pieces of vein from the leg to surgically bypass narrowed coronary arteries.
- examine a blood vessel graft used for dialysis if it is not working as expected; an area of narrowing in the graft may be responsible.

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 will 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 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 scanners consist of a console containing a computer and electronics, a video display screen and a transducer that is used to scan the body. The transducer is a small hand-held device that resembles a microphone, attached to the scanner by a cord. The transducer sends out a high frequency sound wave and then listens for a returning sound wave or "echo".

The ultrasound image is immediately visible on a nearby 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.

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 backward, or echoes. By measuring these echo waves it is possible to determine how far away the object is and its size, shape, consistency (whether the object is solid, filled with fluid, or both) and uniformity.

In medicine, ultrasound is used to detect changes in appearance and function of organs, tissues, or 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 a stream 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. These live images are usually recorded on videotape and 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 (Doppler effect). A computer collects and processes the sounds and creates graphs or 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 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 back and forth over the area of interest.

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 minutes.

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 spread some warm gel on your skin and then press the transducer firmly against your body, moving it back and forth over the area of interest until the desired images are captured. There may be varying degrees of 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 procedure.

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.

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 or referring physician, who will share the results with you. In some cases the radiologist may discuss preliminary results with you at the conclusion of your examination.

What are the benefits vs. risks?

Benefits

- 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 if medically indicated.
- 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, which requires injecting contrast material into a vein, venous ultrasound is nearly as accurate for detecting blood clots in the calf and almost fully as accurate in finding clots in veins of the thigh.

Risks

- For standard diagnostic ultrasound, there are no known harmful effects to 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 clearly. It can be difficult to tell whether a blood clot has totally closed off a vein or whether a small amount of blood is still getting through.