

Ultrasound - Carotid

Carotid ultrasound uses sound waves to produce pictures of the carotid arteries in the neck which carry blood from the heart to the brain. A Doppler ultrasound study – a technique that evaluates blood flow through a blood vessel – is usually part of this exam. It's most frequently used to screen patients for blockage or narrowing of the carotid arteries, a condition called stenosis which may increase the risk of stroke.

Little or no special preparation is required for this procedure. Leave jewelry at home and wear loose, comfortable clothing. A loose-fitting, open necked shirt or blouse is ideal.

What is Carotid 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. 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 (x-rays). 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.

An ultrasound of the body's two carotid arteries, which are located on each side of the neck and carry blood from the heart to the brain, provides detailed pictures of these blood vessels and information about the blood flowing through them.

A Doppler ultrasound study is usually an integral part of a carotid ultrasound examination.

Doppler ultrasound 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 carotid ultrasound is most frequently performed to detect narrowing, or stenosis, of the carotid artery, a condition that substantially increases the risk of stroke.

The major goal of carotid ultrasound is to screen patients for blockage or narrowing of their carotid arteries, which if present may increase their risk of having a stroke. If a significant narrowing is detected, a comprehensive treatment may be initiated.

It may also be performed if a patient has high blood pressure or a carotid bruit (pronounced *brU-E*)—an abnormal sound in the neck that is heard with the stethoscope. In some cases, it is also performed in preparation for coronary artery bypass surgery. Other risk factors calling for a carotid ultrasound are:

- diabetes
- elevated blood cholesterol
- a family history of stroke or heart disease

A carotid ultrasound is also performed to:

- locate a hematoma, a collection of clotted blood that may slow and eventually stop blood flow.

- check the state of the carotid artery after surgery to restore normal blood flow.
- verify the position of a metal stent placed to maintain carotid blood flow.

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

In children, Doppler ultrasound is used to:

- evaluate blood flow.
- predict a higher risk of stroke in children with sickle cell disease.
- detect abnormalities in the blood vessels, lymph nodes and lymphatic vessels.

How should I prepare?

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

A loose-fitting, open necked shirt or blouse is ideal.

Ultrasound exams are very sensitive to motion, and an active or crying child can prolong the examination process. To ensure a smooth experience, it often helps to explain the procedure to the child prior to the exam. Bring books, small toys, music, or games to help distract the child and make the time pass quickly. The exam room may have a television. Feel free to ask for your child's favorite channel.

No other preparation is required.

What does the equipment look like?

Ultrasound machines consist of a computer console, video monitor and an attached transducer. 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 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.

The branches of the carotid arteries inside the head cannot be seen directly but can be evaluated with Doppler ultrasound in children with sickle cell disease. It is performed by placing the transducer over the child's temple and recording the blood flow in the center of the skull.

This ultrasound examination is usually completed within 30 to 45 minutes.

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 or sonographer will apply some warm, water-based gel on your skin and then place the transducer 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.

It may be necessary to tilt or rotate your head for the best exposure, as the transducer is swept over the entire length of your neck on both sides to obtain views of the artery from different perspectives. It also helps to keep your arm and shoulder down. Your head will be supported to keep it still.

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.
- If a carotid ultrasound exam shows narrowing of one or both carotid arteries, treatment can be taken to restore the free flow of blood to the brain. Many strokes are prevented as a result.

Risks

- Standard diagnostic ultrasound has no known harmful effects on humans.
- In nearly 50 years of experience, carotid ultrasound has proved to be a risk-free procedure.

What are the limitations of Carotid Ultrasound Imaging?

- Carotid ultrasound may be difficult or impossible if a patient has a dressing covering a wound or surgical scar in the neck.
- An occasional patient is difficult to examine because of the size or contour of the neck.
- Calcium deposits in the wall of the carotid artery may make it difficult to evaluate the vessel.
- A small amount of soft plaque that produces low-level echoes may go undetected.
- Ultrasound cannot visualize the entire length of the vessel because the last portion of the carotid artery travels through the bone at the base of the skull. For a more complete assessment, patients may need to undergo a CT or MRI of the carotid arteries.

Which test, procedure or treatment is best for me?

- *Suspected Upper-Extremity Deep Vein Thrombosis* (<https://www.radiologyinfo.org/en/info/acs-upper-extremity-dvt>)

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