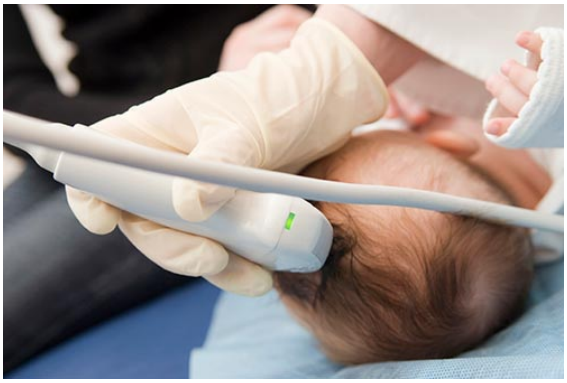
RadiologyInfo.org
For patients

Cranial Ultrasound



Ultrasound imaging of the head uses sound waves to produce pictures of the brain and cerebrospinal fluid. It is usually performed on infants, whose skulls have not completely formed. A transcranial Doppler ultrasound evaluates blood flow in the brain's major arteries. Ultrasound is safe, noninvasive, and does not use ionizing radiation.

This procedure requires little to no special preparation. Your doctor will tell you how to prepare. If you are an adult, you should not use nicotine-based products that may cause blood vessels to constrict. Leave jewelry at home and wear loose, comfortable clothing. You may need to change into a gown for the procedure.

What is cranial ultrasound?

There are two main types of cranial ultrasound:

- *Head ultrasound* that examines the structures of the brain
- *Transcranial Doppler* that evaluates the flow of blood to the brain.

Head Ultrasound

A head ultrasound exam produces images of the brain. It also shows the cerebrospinal fluid (http://www.radiologyinfo.org) that surrounds the brain and is contained within its ventricles (http://www.radiologyinfo.org) . Since ultrasound waves do not pass through bone easily, this exam is usually performed on infants, whose skulls have not completely formed. The gaps between those skull bones provide a "window" that allows the sound waves to freely pass into and back from the brain. The technologist places the ultrasound probe and some gel on one of those head regions without bone, often called “soft spots.”

Transcranial Doppler

A transcranial Doppler (TCD) ultrasound evaluates both the direction and velocity of the blood flow in the major cerebral arteries of the brain. Doctors also use this exam during surgery to monitor blood flow in the brain. Doctors may use TCD alone or with magnetic resonance imaging (http://www.radiologyinfo.org) (MRI), magnetic resonance angiograph (http://www.radiologyinfo.org) (MRA), or computed tomography (http://www.radiologyinfo.org) (CT).

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.

What are some common uses of the procedure?

Head ultrasound is a routine exam for infants who were born prematurely. The procedure is used to screen for brain conditions associated with prematurity, such as bleeding or brain tissue damage as described below. If detected, follow-up ultrasound exams will be performed.

In infants, head ultrasound is used to:

- evaluate for hydrocephalus (http://www.radiologyinfo.org) , or an enlargement of the ventricles, a condition that can have a number of causes.
- detect bleeding within the brain tissue or the ventricles. The latter condition is called intraventricular hemorrhage (IVH).
- assess whether there is damage to the white matter brain tissue surrounding the edges of the ventricles, a condition known as periventricular leukomalacia (PVL).
- evaluate for congenital abnormalities.
- locate the site of an infection or tumor.

In adults, head ultrasound is used to locate and evaluate tumor masses during brain surgery, facilitating their safe removal.

Transcranial Doppler ultrasound is used to assess the risk of stroke in adults and children with sickle cell disease. It is also used to measure conditions affecting blood flow to and within the brain, such as:

- Stenosis (http://www.radiologyinfo.org) : a narrowing of a segment of a vessel, most commonly due to atherosclerosis (hardening of the arteries).
- Vasospasm (http://www.radiologyinfo.org) : a temporary narrowing of a vessel, usually a reaction to blood being present in the spinal fluid spaces surrounding the brain. This condition is known as subarachnoid hemorrhage (SAH).

How should I prepare?

No special preparation is required prior to head or transcranial Doppler ultrasound exams. However, the patient should wear comfortable, loose-fitting clothing

Adults may be asked to stop using nicotine-based products 30 minutes to two hours prior to a transcranial Doppler ultrasound exam. Products with nicotine may cause blood vessels to constrict and give inaccurate results.

Your doctor will provide specific instructions for you or your child prior to the exam.

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?

Head Ultrasound

A head ultrasound is performed in the neonatal intensive care unit (http://www.radiologyinfo.org) (NICU) at the infant's bedside. The infant is positioned lying face-up. A clear, water-based gel is applied to the transducer to help the transducer make secure contact with the body and eliminate air pockets that can block the sound waves from passing into the body. The sonographer (ultrasound technologist) or radiologist then gently presses the transducer against the fontanelle (http://www.radiologyinfo.org) (soft spot of the infant's head, which has no bone to block the passage of the sound waves).

If head ultrasound is used during brain surgery, a portion of the skull will be removed and the exposed brain examined for brain masses with the use of a transducer.

Transcranial Doppler

During a transcranial Doppler ultrasound, the patient is either positioned on his or her back on an examination table or seated upright in an examination chair. A clear water-based gel is applied on the back of the neck, above and lateral to the cheek bone, in front of the ear or over the eyelid, as these are sites for blood vessels that supply the brain. The transducer is gently pressed over one of these areas to measure the direction and speed of the flowing blood.

The patient will need to remain still during the examination, which may take up to 35 minutes. However, if the patient needs to adjust his or her position on the examination table, there is usually no problem in pausing for that time. If the examination is being performed on an infant, a nurse or radiologic technologist may assist with keeping the infant still to ensure the best imaging quality.

What will I experience during and after the procedure?

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

There may be minimal discomfort from pressure, as the technologist presses the transducer against the area being examined. If the gel is not warmed prior to contact with the skin, it could produce a cold sensation.

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.

Risks

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

What are the limitations of cranial ultrasound?

Ultrasound examinations are very sensitive to motion, and an active or crying child will slow the examination process.

Large patients are more difficult to image by ultrasound, because greater amounts of tissue weaken the sound waves as they pass deeper into the body.

Exam results could be altered, due to:

- an open wound or recent surgical incision near the area being imaged.
- changes in blood flow pattern as a result of heart disease or irregular heart rhythms.

Disclaimer

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