



CT Perfusion of the Head

Computed tomography (CT) perfusion of the head uses special x-ray equipment to show which areas of the brain are adequately supplied with blood (perfused) and provides detailed information about blood flow to the brain. CT perfusion is fast, painless, noninvasive and accurate. It's a useful technique for measuring blood flow to the brain, which may be important for treating stroke, brain blood vessel disease and brain tumors.



Tell your doctor if there's a possibility you are pregnant and discuss any recent illnesses, medical conditions, medications you're taking, and allergies. You will be instructed not to eat or drink anything for a few hours beforehand. If you have a known allergy to contrast material, your doctor may prescribe medications to reduce the risk of an allergic reaction. These medications must be taken 12 hours prior to your exam. Leave jewelry at home and wear loose, comfortable clothing. You may be asked to wear a gown.

What is CT Perfusion of the Head?

Computed tomography (CT) perfusion imaging shows which areas of the brain are adequately supplied or perfused with blood and provides detailed information on delivery of blood or blood flow to the brain.

CT perfusion scanning is a noninvasive medical test that helps physicians diagnose and treat medical conditions.

CT scanning combines special x-ray equipment with sophisticated computers to produce multiple images or pictures of the inside of the body. These cross-sectional images of the area being studied can then be examined on a computer monitor, printed or transferred to a CD.

CT scans of internal organs, bones, soft tissue and blood vessels provide greater clarity and reveal more details than regular x-ray exams.

What are some common uses of the procedure?

CT perfusion is typically used to:

- evaluate acute stroke.
- assist with selecting patients for thrombolytic therapy following a stroke by identifying brain tissue at risk of infarction or permanent injury by lack of an adequate blood supply.
- evaluate vasospasm, a sudden blood vessel constriction that may arise from a subarachnoid hemorrhage, in which bleeding occurs in the space between the two membranes surrounding the brain, known as the dura mater and arachnoid membrane.
- assess patients who are candidates for surgical or neuroendovascular treatments. The technique employs special catheters (long, thin tubes), some containing special instruments, that can be manipulated into the area of vessel blockage to dissolve or dislodge a blood clot.
- diagnose and assess treatment response in patients with a variety of brain tumors.

How should I prepare?

You should wear comfortable, loose-fitting clothing to your exam. You may be given a gown to wear during the procedure.

Metal objects, including jewelry, eyeglasses, dentures and hairpins, may affect the CT images and should be left at home or removed prior to your exam. You may also be asked to remove hearing aids and removable dental work. Women will be asked to remove bras containing metal underwire. You may be asked to remove any piercings, if possible.

You will be asked not to eat or drink anything for a few hours beforehand, if contrast material will be used in your exam. You should inform your physician of all medications you are taking and if you have any allergies. If you have a known allergy to contrast material, your doctor may prescribe medications (usually a steroid) to reduce the risk of an allergic reaction. To avoid unnecessary delays, contact your doctor before the exact time of your exam.

Also inform your doctor of any recent illnesses or other medical conditions and whether you have a history of heart disease, asthma, diabetes, kidney disease or thyroid problems. Any of these conditions may increase the risk of an unusual adverse effect.

The radiologist also should know if you have asthma, multiple myeloma or any disorder of the heart, kidneys or thyroid gland, or if you have diabetes—particularly if you are taking Glucophage. Any of these conditions or medications may affect the safety for the administration of contrast material used for this special CT exam.

Women should always inform their physician and the CT technologist if there is any possibility that they may be pregnant. See the Safety page for more information about pregnancy and x-rays.

What does the equipment look like?

CT perfusion is performed on a CT scanner.

The CT scanner is typically a large, box-like machine with a hole, or short tunnel, in the center. You will lie on a narrow examination table that slides into and out of this tunnel. Rotating around you, the x-ray tube and electronic x-ray detectors are located opposite each other in a ring, called a gantry. The computer workstation that processes the imaging information is located in a separate control room, where the technologist operates the scanner and monitors your examination in direct visual contact and usually with the ability to hear and talk to you with the use of a speaker and microphone.

How does the procedure work?

In many ways CT scanning works very much like other x-ray examinations. Different body parts absorb the x-rays in varying degrees. It is this crucial difference in absorption that allows the body parts to be distinguished from one another on an x-ray film or CT electronic image.

In a conventional x-ray exam, a small amount of radiation is aimed at and passes through the part of the body being examined, recording an image on a special electronic image recording plate. Bones appear white on the x-ray; soft tissue, such as organs like the heart or liver, shows up in shades of gray, and air appears black.

With CT scanning, numerous x-ray beams and a set of electronic x-ray detectors rotate around you, measuring the amount of radiation being absorbed throughout your body. Sometimes, the examination table will move during the scan, so that the x-ray beam follows a spiral path. A special computer program processes this large volume of data to create two-dimensional cross-sectional images of your body, which are then displayed on a monitor. CT imaging is sometimes compared to looking into a loaf of bread by cutting the loaf into thin slices. When the image slices are reassembled by computer software, the result is a very detailed multidimensional view of the body's interior.

Refinements in detector technology allow nearly all CT scanners to obtain multiple slices in a single rotation. These scanners, called multislice CT or multidetector CT, allow thinner slices to be obtained in a shorter period of time, resulting in more detail and additional view capabilities.

Modern CT scanners are so fast that they can scan through large sections of the body in just a few seconds, and even faster in small children. Such speed is beneficial for all patients but especially children, the elderly and critically ill, all of whom may have difficulty in remaining still, even for the brief time necessary to obtain images.

How is the procedure performed?

The technologist begins by positioning you on the CT examination table, usually lying flat on your back. Straps and pillows may be used to help you maintain the correct position and to help you remain still during the exam.

Next, the table will move quickly through the scanner to determine the correct starting position for the scans. Then, the table will move slowly through the machine as the actual CT scanning is performed.

Depending on the type of CT scan, the machine may make several passes.

The contrast material will then be injected through an intravenous line (IV) while additional scans are obtained. In most cases, the contrast material is injected by a special machine attached to the IV line, which ensures precise delivery of the contrast material at a rate and time period prescribed by the radiologist. Such accuracy in injection is required for a successful perfusion CT scan.

You may be asked to hold your breath during the scanning. Any motion, whether breathing or body movements, can lead to artifacts on the images. This loss of image quality can resemble the blurring seen on a photograph taken of a moving object.

When the examination is completed, you will be asked to wait until the technologist verifies that the images are of high enough quality for accurate interpretation.

A CT perfusion scan of the head is usually completed in 25 minutes.

What will I experience during and after the procedure?

CT exams are generally painless, fast and easy. With multidetector CT, the amount of time that the patient needs to lie still is reduced.

Though the scanning itself causes no pain, there may be some discomfort from having to remain still for several minutes. If you have a hard time staying still, are claustrophobic or have chronic pain, you may find a CT exam to be stressful. The technologist or nurse, under the direction of a physician, may offer you some medication to help you tolerate the CT scanning procedure.

However, the very open design of a modern CT scanner rarely causes a claustrophobic sensation.

When the intravenous contrast material is injected, you will feel a pinprick as the needle is inserted into your vein, which is usually located in your arm, near the crease in your elbow.

You may have a warm, flushed sensation during the injection of the contrast material and a metallic taste in your mouth that lasts for a few minutes. Some patients may experience a sensation like they have to urinate, but this subsides quickly.

When you enter the CT scanner, special light lines may be seen projected onto your body, and are used to ensure that you are properly positioned. With modern CT scanners, you will hear only slight buzzing, clicking and whirring sounds as the CT scanner's internal parts, not usually visible to you, revolve around you during the imaging process.

You will be alone in the exam room during the CT scan, unless there are special circumstances. For example, sometimes a parent wearing a lead shield may stay in the room with their child. However, the technologist will always be able to see, hear and speak with you through a built-in intercom system.

After a CT exam, the intravenous line used to inject the contrast material will be removed by the technologist, and the tiny hole made by the needle will be covered with a small dressing. You can return to your normal activities.

Who interprets the results and how do I get them?

A radiologist who is a physician with special skills and expertise in supervising and interpreting radiology examinations, will analyze the images and send an official report to your primary care physician or physician who referred you for the exam, who will discuss the results with you.

What are the benefits vs. risks?

Benefits

- CT perfusion is a useful technique for measuring perfusion in the brain. Measuring perfusion may be important for treating stroke, other blood vessel diseases of the brain and brain tumors.
- CT scanning is painless, noninvasive and accurate.
- A major advantage of CT is its ability to image bone, soft tissue and blood vessels all at the same time.
- Unlike conventional x-rays, CT scanning provides very detailed images of many types of tissue as well as the lungs, bones, and blood vessels.
- CT examinations are fast and simple; in emergency cases, they can reveal internal injuries and bleeding quickly enough to help save lives.
- CT has been shown to be a cost-effective imaging tool for a wide range of clinical problems.
- CT can be performed if you have an implanted medical device of any kind.
- A diagnosis determined by CT scanning may eliminate the need for exploratory surgery and surgical biopsy.
- No radiation remains in a patient's body after a CT examination.
- X-rays used in CT scans should have no immediate side effects.

Risks

- There is always a slight chance of cancer from excessive exposure to radiation. However, the benefit of an accurate diagnosis far outweighs the risk.
- The effective radiation dose for this procedure varies. See the Safety page for more information about radiation dose.
- Every effort is made to use the lowest radiation dose possible, while not sacrificing the quality of the CT images necessary to effectively diagnose a disease process. Nearly all CT scanners now have special computer programs that help to increase image quality at lower radiation doses.
- Women should always inform their physician and x-ray or CT technologist if there is any possibility that they are pregnant. See the Safety page for more information about pregnancy and x-rays.
- CT scanning is, in general, not recommended for pregnant women unless medically necessary because of potential risk to the baby. This risk is, however, minimal with head CT scanning, as the x-ray beam is confined to the head, far away from the abdominal cavity where the baby lies.
- Nursing mothers should wait for 24 hours after contrast material injection before resuming breast-feeding.

- The risk of serious allergic reaction to contrast materials that contain iodine is extremely rare, and radiology departments are well-equipped to deal with them.

What are the limitations of CT Perfusion of the Head?

A person who is very large may not fit into the opening of a conventional CT scanner or may be over the weight limit—usually 450 pounds—for the moving table.

Disclaimer

This information is copied from the RadiologyInfo Web site (<http://www.radiologyinfo.org>) which is dedicated to providing the highest quality information. To ensure that, each section is reviewed by a physician with expertise in the area presented. All information contained in the Web site is further reviewed by an ACR (American College of Radiology) - RSNA (Radiological Society of North America) committee, comprising physicians with expertise in several radiologic areas.

However, it is not possible to assure that this Web site contains complete, up-to-date information on any particular subject. Therefore, ACR and RSNA make no representations or warranties about the suitability of this information for use for any particular purpose. All information is provided "as is" without express or implied warranty.

Please visit the RadiologyInfo Web site at <http://www.radiologyinfo.org> to view or download the latest information.

Note: Images may be shown for illustrative purposes. Do not attempt to draw conclusions or make diagnoses by comparing these images to other medical images, particularly your own. Only qualified physicians should interpret images; the radiologist is the physician expert trained in medical imaging.

Copyright

This material is copyrighted by either the Radiological Society of North America (RSNA), 820 Jorie Boulevard, Oak Brook, IL 60523-2251 or the American College of Radiology (ACR), 1891 Preston White Drive, Reston, VA 20191-4397. Commercial reproduction or multiple distribution by any traditional or electronically based reproduction/publication method is prohibited.

Copyright © 2018 Radiological Society of North America, Inc.