

## Head CT

Computed tomography (CT) of the head uses special x-ray equipment to help assess head injuries, severe headaches, dizziness, and other symptoms of aneurysm, bleeding, stroke, and brain tumors. It also helps your doctor to evaluate your face, sinuses, and skull or to plan radiation therapy for brain cancer. In emergency cases, it can reveal internal injuries and bleeding quickly enough to help save lives.

Tell your doctor if there's a possibility you are pregnant. Discuss any recent illnesses, medical conditions, medications you're taking, and allergies. If your exam needs intravenous contrast, your doctor may tell you 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. Leave jewelry at home and wear loose, comfortable clothing. You may need to change into a gown for the procedure.



### What is a head CT?

Computed tomography, more commonly known as a CT or CAT scan, is a diagnostic medical imaging test. Like traditional x-rays, it produces multiple images or pictures of the inside of the body.

A CT scan generates images that can be reformatted in multiple planes. It can even generate three-dimensional images. Your doctor can review these images on a computer monitor, print them on film or via a 3D printer, or transfer them to a CD or DVD.

CT images of internal organs, bones, soft tissue, and blood vessels provide greater detail than traditional x-rays. This is especially true for soft tissues and blood vessels.

CT scanning provides more detailed information on head injuries, stroke (<https://www.radiologyinfo.org/en/info/stroke>), brain tumors, and other brain diseases than regular x-rays.

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

Doctors typically use head CT to detect:

- bleeding, brain injury and skull fractures in patients with head injuries.
- bleeding caused by a ruptured or leaking aneurysm in a patient with a sudden severe headache.
- a blood clot (<https://www.radiologyinfo.org/en/info/bloodclot>) or bleeding within the brain in a patient with symptoms of a stroke.
- a stroke, especially with a technique called CT perfusion of the head (<https://www.radiologyinfo.org/en/info/perfusionheadct>).
- brain tumors (<https://www.radiologyinfo.org/en/info/brainumor>).
- enlarged brain cavities (ventricles) in patients with hydrocephalus.
- diseases or malformations of the skull.

Doctors also perform head CT to:

- evaluate the extent of bone and soft tissue damage in patients with facial trauma, and plan surgical reconstruction.
- diagnose diseases of the temporal bone on the side of the skull, which may be causing hearing problems.
- determine whether inflammation or other changes are present in the paranasal sinuses.
- plan radiation therapy for cancer of the brain or other tissues.
- guide the passage of a needle used to obtain a tissue sample (biopsy) from the brain.
- assess aneurysms, arteriovenous malformations, and blood vessels through a technique called CT angiography. *For more information, see the [CT Angiography](https://www.radiologyinfo.org/en/info/angiocr) (<https://www.radiologyinfo.org/en/info/angiocr>) page.*

## How should I prepare?

Wear comfortable, loose-fitting clothing to your exam. You may need to change into a gown for the procedure.

Metal objects, including jewelry, eyeglasses, dentures, and hairpins, may affect the CT images. Leave them at home or remove them prior to your exam. Some CT exams will require you to remove hearing aids and removable dental work. Women will need to remove bras containing metal underwire. You may need to remove any piercings, if possible.

Your doctor may instruct you to not eat or drink anything for a few hours before your exam if it will use contrast material. Tell your doctor about 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 well before the date of your exam.

Also tell your doctor about 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 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 Metformin .

Women should always inform their physician and the CT technologist if there is any possibility that they may be pregnant. *See the [CT Safety During Pregnancy](https://www.radiologyinfo.org/en/info/safety-ct-pregnancy) (<https://www.radiologyinfo.org/en/info/safety-ct-pregnancy>) page for more information.*

## What does the equipment look like?

The CT scanner is typically a large, donut-shaped machine with a short tunnel in the center. You will lie on a narrow table that slides in and out of this short 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 in a separate control room. This is where the technologist operates the scanner and monitors your exam in direct visual contact. The technologist will be able to hear and talk to you using a speaker and microphone.

## How does the procedure work?

In many ways, a CT scan works like other x-ray exams. Different body parts absorb x-rays in different amounts. This difference allows the doctor to distinguish body parts from one another on an x-ray or CT image.

A conventional x-ray exam directs a small amount of radiation through the body part under examination. A special electronic image recording plate captures the image. Bones appear white on the x-ray. Soft tissue, such as the heart or liver, shows up in shades of gray. Air appears black.

With CT scanning, several x-ray beams and electronic x-ray detectors rotate around you. These measure the amount of radiation

being absorbed throughout your body. Sometimes, the exam table will move during the scan. A special computer program processes this large volume of data to create two-dimensional cross-sectional images of your body. The system displays the images on a computer monitor. CT imaging is sometimes compared to looking into a loaf of bread by cutting the loaf into thin slices. When the computer software reassembles the image slices, the result is a very detailed multidimensional view of the body's interior.

Nearly all CT scanners can obtain multiple slices in a single rotation. These multi-slice (multidetector) CT scanners obtain thinner slices in less time. This results in more detail.

Modern CT scanners can image large sections of the body in just a few seconds, and even faster in small children. Such speed is beneficial for all patients. Speed is especially beneficial for children, the elderly, and critically ill – anyone who finds it difficult to stay still, even for the brief time necessary to obtain images.

For children, the radiologist will adjust the CT scanner technique to their size and the area of interest to reduce the radiation dose.

Some CT exams use a contrast material to enhance visibility in the body area under examination.

## **How is the procedure performed?**

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

Many scanners are fast enough to scan children without sedation. In special cases, children who cannot hold still may need sedation. Motion may cause blurring of the images and degrade image quality the same way that it affects photographs.

The exam may use contrast material, depending on the type of exam. If so, it will be swallowed, injected through an intravenous line (IV) or, rarely, administered by enema.

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

The technologist may ask you to hold your breath during the scanning. Any motion, including breathing and 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 exam is complete, the technologist will ask you to wait until they verify that the images are of high enough quality for accurate interpretation by the radiologist.

A CT scan of the head usually takes about 10 minutes.

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

CT exams are generally painless, fast, and easy. Multidetector CT reduces the amount of time that the patient needs to lie still.

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.

If the exam uses iodinated contrast material, your doctor will screen you for chronic or acute kidney disease. The doctor may administer contrast material intravenously (by vein), so you will feel a pin prick when the nurse inserts the needle into your vein. You may feel warm or flushed as the contrast is injected. You also may have a metallic taste in your mouth. This will pass. You may feel a need to urinate. However, these are only side effects of the contrast injection, and they subside quickly.

When you enter the CT scanner, you may see special light lines projected onto your body. These lines help ensure that you are in the correct position on the exam table. With modern CT scanners, you may hear slight buzzing, clicking and whirring sounds. These occur 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.

With pediatric patients, a parent may be allowed in the room but may need to wear a lead apron to minimize radiation exposure.

After a CT exam, the technologist will remove your intravenous line. They will cover the tiny hole made by the needle with a small dressing. You can return to your normal activities immediately.

## Who interprets the results and how do I get them?

A radiologist (<https://www.radiologyinfo.org/en/info/article-your-radiologist>), a doctor specially trained to supervise and interpret radiology exams, will analyze the images. The radiologist will send an official report to the doctor who ordered 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

- 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 exams 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 is less sensitive to patient movement than MRI.
- Unlike MRI, an implanted medical device of any kind will not prevent you from having a CT scan.
- 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 exam.
- The x-rays used for CT scanning 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 involved with CT scanning.
- The radiation dose for this procedure varies. *See the Radiation Dose* (<https://www.radiologyinfo.org/en/info/safety-xray>) *page for more information.*
- Women should always tell their doctor and x-ray or CT technologist if there is any chance they are pregnant. *See the* (<https://www.radiologyinfo.org/en/info/safety-radiation>) *Radiation Safety* (<https://www.radiologyinfo.org/en/info/safety-radiation>) *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.

- IV contrast manufacturers indicate mothers should not breastfeed their babies for 24-48 hours after contrast material is given. However, the most recent American College of Radiology (ACR) Manual on Contrast Media reports that studies show the amount of contrast absorbed by the infant during breastfeeding is extremely low. *For further information please consult the ACR Manual on Contrast Media (<https://www.acr.org/Clinical-Resources/Contrast-Manual>) and its references.*
- 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.
- Because children are more sensitive to radiation, they should have a CT exam only if it is essential for making a diagnosis. They should not have repeated CT exams unless necessary. CT scans in children should always be done with low-dose technique.

## What are the limitations of a head CT scan?

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

Compared to MR imaging, the precise details of soft tissue (particularly the brain, including the disease processes) are less visible on CT scans. CT is not sensitive in detecting inflammation of the meninges—the membranes covering the brain.

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