RadiologyInfo.org

The radiology information resource for patients

# Computed Tomography (CT) - Head

## What is CT Scanning of the Head?

CT scanning—sometimes called CAT 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.

CT scanning provides more detailed information on head injuries, stroke, brain tumors and other brain diseases than regular radiographs (x-rays).

## What are some common uses of the procedure?

CT scanning of the head is typically used 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 or bleeding within the brain shortly after a patient exhibits symptoms of a stroke.
- a stroke, especially with a new technique called Perfusion CT.
- brain tumors.
- enlarged brain cavities (ventricles) in patients with hydrocephalus.
- diseases or malformations of the skull.

CT scanning is also performed to:

- evaluate the extent of bone and soft tissue damage in patients with facial trauma, and planning 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 or arteriovenous malformations through a technique called CT angiography.

For more information, see the CT Angiography page (www.RadiologyInfo.org/en/info.cfm?pg=angioct).

## 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 not to eat or drink anything for several hours beforehand, especially if a contrast material will be used in your exam. You should inform your physician of any medications you are taking and if you have any allergies. If you have a known allergy to contrast material, or "dye," your doctor may prescribe medications to reduce the risk of an allergic reaction.

Also inform your doctor of any recent illnesses or other medical conditions, and if 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.

Women should always inform their physician and the CT technologist if there is any possibility that they are pregnant. See the Safety page (www.RadiologyInfo.org/en/safety/) for more information about pregnancy and x-rays.

## What does the equipment look like?

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 room, where the technologist operates the scanner and monitors your examination.

## How does the procedure work?

In many ways CT scanning works very much like other x-ray examinations. X-rays are a form of radiation—like light or radio waves—that can be directed at the body. Different body parts absorb the x-rays in varying degrees.

In a conventional x-ray exam, a small burst of radiation is aimed at and passes through the body, recording an image on photographic film or a special image recording plate. Bones appear white on the x-ray; soft tissue 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. At the same time, the examination table is moving through the scanner, 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. This technique is called helical or spiral CT.

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 new 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. Such speed is beneficial for all patients but especially children, the elderly and critically ill.

For children, the CT scanner technique will be adjusted to reduce the radiation dose.

For some CT exams, a contrast material is used to enhance visibility in the area of the body being studied.

## How is the procedure performed?

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

For children who cannot hold still for the examination, sedation may be needed. Motion will degrade the quality of the examination the same way that it affects photographs.

If contrast material is used, it will be swallowed, injected through an intravenous line (IV) or administered by enema, depending on the type of examination.

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.

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 is similar to 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 scan of the head is usually completed within 10 minutes.

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

CT exams are generally painless, fast and easy. With helical 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 a mild sedative to help you tolerate the CT scanning procedure.

If an intravenous contrast material is used, you will feel a slight pin prick when the needle is inserted into your vein. You may have a warm, flushed sensation during the injection of the contrast materials 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 lights may be 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 revolves around you during the imaging process.

You will be alone in the exam room during the CT scan. However, the technologist will be able to see, hear and speak with you at all times.

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

After a CT exam, you can return to your normal activities. If you received contrast material, you may be given special instructions.

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

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

## 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 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 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 is less sensitive to patient movement than MRI.
- CT can be performed if you have an implanted medical device of any kind, unlike MRI.
- 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 usually 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 from this procedure is about 2 mSv, which is about the same as the average person receives from background radiation in eight months. See the Safety page (www.RadiologyInfo.org/en/safety/) for more information about radiation dose.
- 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 (www.RadiologyInfo.org/en/safety/ ) 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.
- 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.
- Because children are more sensitive to radiation, they should have a CT study only if it is essential for making a diagnosis and should not have repeated CT studies unless absolutely necessary.

## What are the limitations of CT Scanning 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 for the moving table which is usually about 450 pounds.

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.

## Additional Information and Resources

### RadiologyInfo

Brain Tumors:
www.RadiologyInfo.org/en/info.cfm?pg=thera-brain

Head and Neck Cancer:
www.RadiologyInfo.org/en/info.cfm?pg=hdneck

## RTAnswers.org

Radiation Therapy for Brain Tumors:
www.rtanswers.com/treatmentinformation/cancertypes/brain/index.aspx

Radiation Therapy for Head and Neck Cancer:
www.rtanswers.com/treatmentinformation/cancertypes/headneck/index.aspx

## Others

American Stroke Association:
www.strokeassociation.org

National Stroke Association:
www.stroke.org