Computed tomography (CT) of the chest uses special x-ray equipment to examine abnormalities found in other imaging tests and to help diagnose the cause of unexplained cough, shortness of breath, chest pain, fever and other chest symptoms. CT scanning is fast, painless, noninvasive and accurate. Because it is able to detect very small nodules in the lung, chest CT is especially effective for diagnosing lung cancer at its earliest, most curable stage.

Tell your doctor if there is a possibility you are pregnant and discuss any recent illnesses, medical conditions, medications you are 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 beginning 12 hours prior to your exam. Leave jewelry at home and wear loose, comfortable clothing. You may be asked to wear a gown.

For information on coronavirus (COVID-19) or how COVID-19 vaccine side effects could affect your imaging results, see the Medical Imaging and Coronavirus Safety page.

What is CT Scanning of the Chest?

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.

Using a variety of techniques, including adjusting the radiation dose based on patient size and new software technology, the amount of radiation needed to perform a chest CT scan can be significantly reduced. A low-dose chest CT produces images of sufficient quality to detect many lung diseases and abnormalities using much less radiation than a conventional chest CT scan—in some cases lowering the dose by 65 percent or more. Low dose chest CT is routinely used for evaluation of acquired and congenital lung abnormalities, such as pneumonia, interstitial lung disease or tumor evaluation. There is ongoing research to lower radiation doses even further. Your radiologist will decide the proper settings to be used for your scan depending on your medical problems and what information is needed from the CT scan. If your child is to have a CT scan, the proper low-dose pediatric settings should be used.
What are some common uses of the procedure?

Chest CT is used to:

- examine abnormalities found on conventional chest x-rays.
- help diagnose the causes of clinical signs or symptoms of disease of the chest, such as cough, shortness of breath, chest pain, or fever.
- detect and evaluate the extent of tumors that arise in the chest, or tumors that have spread there from other parts of the body.
- assess whether tumors are responding to treatment.
- help plan radiation therapy.
- evaluate injury to the chest, including the heart, blood vessels, lungs, ribs and spine.
- evaluate abnormalities of the chest found on fetal ultrasound examinations.

Chest CT can demonstrate various lung disorders, such as:

- benign and malignant tumors.
- pneumonia.
- tuberculosis.
- inflammation or other diseases of the pleura (the covering of the lungs).
- interstitial and chronic lung disease.
- congenital abnormalities.

CT scanning has recently been approved for screening asymptomatic people who have smoked a significant amount of cigarettes by the Centers for Medicare and Medicaid Services. See the Lung Cancer Screening (https://www.radiologyinfo.org/en/info/screening-lung) page for more information.

A CT angiogram (CTA) may be performed to evaluate the blood vessels (arteries and veins) in the chest. This involves the rapid injection of an iodine-containing fluid (contrast material) into a vein while obtaining CT images. See the CT Angiography (https://www.radiologyinfo.org/en/info/angioct) (CTA) page for more information.

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.

Women should always inform their physician and the CT technologist if there is any possibility that they may be pregnant. See the
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.

To produce high-quality scans at a lower radiation dose, low-dose CT scanning uses a variety of techniques, including:

- dose modulation, in which radiation dosage is continuously adjusted to the patient's size at each location as the patient moves through the scanner
- "noise management" software to filter out unnecessary data
- the use of shields (this method depends on the type of CT scanner being used)
- external shields made out of bismuth may be placed on the patient
- the x-ray tube may be turned off during part of its rotation
- lower peak voltage settings

Your radiologist will select the appropriate dose reduction method(s) to accomplish the lowest possible dose necessary to answer the clinical question at hand.

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.

If a contrast material is used, it will be injected into a vein shortly before scanning begins.

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.

The actual CT scanning takes less than 30 seconds and the entire process, including exam preparation, is usually completed within 30 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 scan is painless, you may have some discomfort from remaining still for several minutes or from placement of an IV. If you have a hard time staying still, are very nervous, anxious, or in pain, you may find a CT exam stressful. The technologist or nurse, under the direction of a doctor, may offer you some medication to help you tolerate the CT exam.

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.

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 is fast, which is important for patients who have trouble holding their breath.
- CT is widely available.
- 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.
- CT imaging provides real-time imaging, making it a good tool for guiding needle biopsies and needle aspirations. This is particularly true of procedures involving the lungs, abdomen, pelvis, and bones.
- A diagnosis via CT scan 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.
- Low-dose CT scans of the chest use a lower dose of radiation than conventional chest CT.

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 in X-Ray and CT Exams (https://www.radiologyinfo.org/en/info/safety-xray) page for more information about radiation dose.
- Women should always tell their doctor and x-ray or CT technologist if there is any chance they are pregnant. See the Safety in X-ray, Interventional Radiology and Nuclear Medicine Procedures (https://www.radiologyinfo.org/en/info/safety-radiation) page for more information about pregnancy and x-rays.
- Doctors do not generally recommend CT scanning for pregnant women unless medically necessary because of potential risk to the unborn baby.
- 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.
- In some patients with reduced kidney function, the dye used in CT scanning may worsen kidney function.
- 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 CT Scanning of the Chest?

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.

Magnetic resonance imaging (MRI) may be better than CT for showing some types of soft-tissue abnormalities.
Even though the CT exam is very fast, motion from breathing or body movement during the exam may result in blurring of the images.

**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 © 2021 Radiological Society of North America, Inc.