

## Computed Tomography (CT) - Chest

*This procedure is reviewed by a physician with expertise in the area presented and is further reviewed by committees from the American College of Radiology (ACR) and the Radiological Society of North America (RSNA), comprising physicians with expertise in several radiologic areas.*

### What is CT Scanning of the Chest?

Computed tomography (also known as CT or CAT scanning) of the chest uses special equipment to obtain multiple cross-sectional images of the organs and tissues of the chest. CT produces images that are far more detailed than a conventional chest x-ray. CT is especially useful because it can simultaneously show many different types of tissue, including the lungs, heart, bones, soft tissues, muscle and blood vessels. Modern CT scans utilize a method called spiral (or helical) CT that captures images of the chest from many angles and, with the aid of a computer, processes the images to create cross-sectional pictures or "slices" of the area of interest. The images can then be printed out or examined on a monitor.

CT scanning is considered to be a "patient-friendly" procedure because it involves relatively low radiation exposure and is not invasive. Contrast material is sometimes injected through a vein to make the blood vessels and soft-tissue masses stand out. During the CT examination patients usually lie flat on their back, but occasionally they may be asked to lie on their side or on their stomach. Patients are periodically asked to hold their breath. No preparation is required prior to the exam. Patients generally do not require a sedative to remain calm.

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

CT of the chest is used to take a closer look at findings detected on conventional chest x-rays or may be used to investigate and try to explain clinical signs or symptoms of disease of the chest. The CT examination may provide more specific information regarding the nature and extent of the findings or, in some cases, determine that the chest is normal.

CT may be used to detect and evaluate the extent of tumors that arise in the lung and mediastinum, or tumors that have spread there from other parts of the body. CT is routinely used to assess whether tumors are responding to treatment.

You may have heard that, in recent years, some people have chosen to have a chest CT scan to screen for lung cancer. This makes the most sense for those who are former or current cigarette smokers, as they are at much greater risk of cancer than are nonsmokers. The best hope of curing lung cancer is to find it as early as possible, making it easier to treat. CT is able to detect even very small abnormalities that could be early lung cancer, which would not be visible on a conventional chest x-ray. A special low-dose CT technique is used for lung cancer screening. CT of the chest is not able to detect every cancer.

When someone has abnormal CT findings but the cause is uncertain, a percutaneous needle biopsy may be needed to directly examine the tissue. CT can be used to help guide the biopsy needle to the area in question.

Chest CT also can demonstrate other lung disorders, such as old or new pneumonia, tuberculosis, emphysema, bronchiectasis, and diffuse interstitial lung disease. When the clinical findings and regular chest x-ray are inconclusive, CT may clarify the situation. Inflammation or other diseases of the pleura, the membrane covering the lungs, can be seen in CT images. High-resolution CT (HRCT) may be used for further evaluation. This uses thinner slices with possible expiration and prone views.

A CT angiogram (CTA) may be performed to evaluate the blood vessels (arteries and veins) in the chest. This involves injecting the iodine into a vein a little faster, and also, more numerous and thinner slices are obtained through the chest in order to see the arteries to better advantage. See the CT Angiography (CTA) page for more information.

## How should I prepare for the CAT scan?

You should dress comfortably but avoid any clothing in the chest area that has a zipper, snaps or jewelry, since metal objects may affect the CT images. Women should always inform their physician or the x-ray technologist if there is any possibility that they are pregnant.

## What does the equipment look like?

The CT scanner is a large unit with a hole running directly through its center, giving the appearance of a doughnut. The patient lies on a table that can move up or down and can slide into and out of the center of the cavity. The computer is not in the examining room, but in an adjoining room.



## How does the procedure work?

X-rays emitted from a rotating x-ray tube pass through the patient's body. Different tissues absorb this radiation in different amounts. Radiation leaving the body is recorded by an array of detectors that are mounted on the gantry, along with the x-ray tube. During each rotation, about 1,000 images are recorded with the x-ray beam. These images are then reconstructed by a computer into a very detailed two-dimensional view of the interior of the body. As the x-ray source rotates and, at the same time, the patient lying on the examination table advances through the scanner at a constant rate, the x-ray beam follows a spiral path—hence, the term "spiral" CT scanning.

The most recent spiral CT units produce higher-quality images in a shorter time. This is an especially important feature for children and for patients who are elderly or critically ill, as well as those who cannot hold their breath for a long time. Modern scanners are able to image large regions of the body, such as the lungs,

during a single breath hold of about 20 seconds or less. If a suspicious nodule is found, additional scans may be done to obtain greater detail. It now is possible to combine multiple CT images to produce a three-dimensional display that provides additional information.

## How is the CAT scan performed?

The first step is for the technologist to make certain that you are correctly positioned on the CT table. Pillows may be used to help maintain the correct position during the examination. For the initial scans, the table will move rapidly through the scanner to determine the correct starting position. The rest of the scans are made as the table moves more slowly through the cavity in the scanner. The best chest CT scans are obtained when you are able to hold your breath. If this is not possible, you will be asked to breathe quietly and regularly.

Under certain circumstances, as when evaluating blood vessels, you will have contrast material injected into a vein shortly before scanning begins. If this is necessary, you may be asked whether you have any allergies to medications or iodine (which is a part of many contrast materials) and whether you have a history of asthma, diabetes, a heart disorder, multiple myeloma or kidney disease. These conditions may indicate a greater risk of an adverse reaction to contrast material. Kidney disease makes it harder to eliminate contrast material from the bloodstream.

After the CT examination is completed, you may have to wait a short time while the radiologist checks the scans to make sure the quality is good enough to be correctly interpreted. If necessary, a few additional scans will be obtained.

## What will I experience during the procedure?

CT scanning is a pain-free procedure. If contrast material is injected, you may feel a flush of heat or a metallic taste in your mouth, usually lasting no more than a minute or two. You also may notice mild itching. If this persists or hives develop, effective medication is available. Very rarely a patient becomes short of breath or has swelling in the throat or another part of the body, indicating a more serious reaction to contrast material that must be promptly treated. If you experience any of these symptoms, inform the technologist immediately.

You will be alone during the scan, but the technologist can see and hear you and can speak to you at any time from the adjacent control room. The examination usually

takes 15 to 30 minutes, including preparation time. The actual scan time is less than 30 seconds.

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

A radiologist experienced in CT scanning will examine and interpret the CT findings. After reaching a conclusion, the radiologist will send a detailed report to your primary care or referring physician, who will give you the results.

## What are the benefits vs. risks?

### Benefits

- Unlike conventional x-rays, CT scanning provides very detailed images of a wide range of body organs and tissues.
- CT is fast. This is especially important for patients with chest injury, because internal damage or bleeding can be diagnosed in time to give life-saving treatment.
- There is no pain from CT. Apart from an intravenous injection if needed, the procedure is non-invasive.
- CT can show lung tumors when they are smaller in size than will be visible with conventional x-rays and are easier to treat.
- Because it shows both normal and abnormal tissues, CT scanning is a convenient way of guiding needle biopsies.
- CT can help in planning radiotherapy.
- A CT diagnosis may eliminate the need for exploratory surgery.

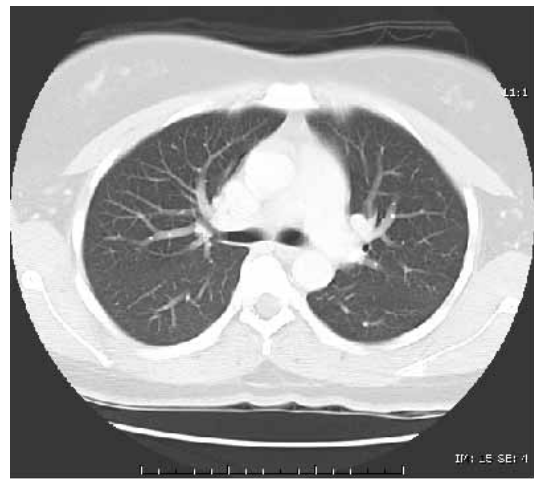
### Risks

- Chest CT requires exposure to radiation, but the risk is considered so low that it is far outweighed by the benefit of making an accurate diagnosis. Radiologists use the smallest radiation dose that will provide accurate results. The effective radiation dose from this procedure is about 8 mSv, which is about the same as an average person receives from background radiation in 3 years.

- Women should always inform their doctor or x-ray technologist if there is any possibility that they are pregnant.
- If you are a nursing mother and received contrast material for your CT exam, you should wait 24 hours before resuming breast-feeding to allow your body time to eliminate the material.
- There is a very small but real risk of having a serious allergic reaction to contrast material that contains iodine, but CT staff will be able to deal with it.

## What are the limitations of CT Scanning of the Chest?

- Motion can lessen the quality of a CT study.
- CT scanning is generally not recommended for pregnant women.
- Magnetic resonance imaging (MRI) may be better than CT for showing very fine soft-tissue detail.



*Sample image: CT of the lungs, window level set to demonstrate the vessels and air ways - not intended to demonstrate the heart, spine muscles etc. This is used to look for things like pneumonia or lung cancer.*



*Sample image: CT angiogram. Frontal or coronal view of chest-3D slab image showing pulmonary vessels.*

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