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?

CT scanning—sometimes called CAT scanning—is a noninvasive, painless medical test that helps physicians diagnose and treat medical conditions.

CT imaging uses special x-ray equipment to produce multiple images or pictures of the inside of the body and a computer to join them together in cross-sectional views of the area being studied. The images can then be examined on a computer monitor or printed.

CT scans of internal organs, bone, soft tissue and blood vessels provide greater clarity than conventional x-ray exams.

CT produces images that are far more detailed than a conventional chest x-ray.

What are some common uses of the procedure?

CT of the chest is used to:

- further examine abnormalities found on conventional chest x-rays
- help diagnose clinical signs or symptoms of disease of the chest
- 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
- assess whether tumors are responding to treatment
- help plan radiotherapy

A chest CT scan can also be used to screen for lung cancer in former or current cigarette smokers who are at much greater risk of cancer than nonsmokers. CT is able to detect even very small abnormalities that could be early lung cancer and are not be visible on a conventional chest x-ray.

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
- inflammation or other diseases of the pleura, the membrane covering the lungs
- diffuse interstitial lung disease

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.

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.

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, especially to contrast materials.

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.

Women should always inform their physician or technologist if there is any possibility that they are pregnant.

What does the equipment look like?

The CT scanner is typically a large machine with a hole, or tunnel, in the center. A moveable examination table slides into and out of this tunnel. In the center of the machine, the x-ray tube and electronic x-ray detectors are located opposite each other on a ring, called a gantry, which rotates around you. The computer that processes the imaging information and monitor are located in a separate room.

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 series of pictures, or slices of your body, to create two-dimensional cross-sectional images, 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 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 capability.

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.

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.

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 as the actual CT scanning is performed.

You may be asked to hold your breath during the scanning.

When the examination is completed, you will be asked to wait until the technologist determines that the images are of high enough quality for the radiologist to read.

The actual CT scanning takes less than 30 seconds and the entire process is usually completed within 30 minutes.

What will I experience during and after the procedure?

Most CT exams are painless, fast and easy. With spiral 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 may offer you a mild sedative to help.

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. Occasionally, a patient will develop itching and hives, which can be relieved with medication. If you become light-headed or experience difficulty breathing, you should notify the technologist or nurse, as it may indicate a more severe allergic reaction.

If the contrast material is swallowed, you may find the taste mildly unpleasant; however, most patients can easily tolerate it. You can expect to experience a sense of abdominal fullness and an increasing need to expel the liquid if your contrast material is given by enema. In this case, be patient, as the mild discomfort will not last long.

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 prevent radiation exposure.

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

Who interprets the results and how do I get them?

A radiologist, a physician specifically trained to supervise and interpret radiology examinations, will analyze the images and send a signed report to your primary care or referring physician, who will share the results with you.

What are the benefits vs. risks?

Benefits

- 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.
- CT scanning is painless, noninvasive and accurate.
- A major advantage of CT is that it is able 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 may be less expensive than MRI. In addition, it is less sensitive to patient movement.
- CT can be performed if you have an implanted medical device of any kind, unlike MRI.
- CT imaging provides real-time imaging, making it a good tool for guiding minimally invasive procedures such as needle biopsies and needle aspirations of many areas of the body, particularly the lungs, abdomen, pelvis and bones.
- 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 side effects.

Risks

- There is always a slight chance of cancer from radiation. However, the benefit of an accurate diagnosis far outweighs the risk.
- The effective radiation dose from this procedure is about 8 mSv, which is about the same as the average person receives from background radiation in three years.
• Women should always inform their physician or x-ray technologist if there is any possibility that they are pregnant.

• CT scanning is, in general, not recommended for pregnant women because of potential risk to the baby.

• Nursing mothers should wait for 24 hours after intravenous contrast material injection before resuming breast-feeding.

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

• Children 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 Chest?

A person who is very obese may not fit into the opening of a conventional CT unit.

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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