

Computed Tomography (CT) - Spine

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 Spine?

Computed tomography (better known as CT or CAT scan) of the spine, is a type of x-ray examination that uses a machine called a scanner to obtain multiple images of the spinal column, as well as three-dimensional images if needed. Modern CT scanners employ a method called spiral (or helical) CT, which produces images of the spine and, with the aid of a computer, processes the images to create cross-sectional "slices" of the area of interest. These images may be examined on a computer monitor or printed out and viewed like conventional x-rays. CT images are far more detailed than those obtained by a conventional x-ray unit. In addition, CT is a very useful diagnostic method because it can display and distinguish many different types of tissue in the same region, including bone, muscle, soft tissue and blood vessels.

Compared to regular x-rays, CT scanning uses a relatively low dose of radiation. It is not an invasive procedure, although contrast material sometimes is injected into a vein before scanning to show fine structural details and highlight any abnormalities. The bony structure of the spinal vertebrae is clearly and accurately shown by CT scanning, as are the intervertebral disks and, to some degree, the spinal cord.

What are some common uses of the procedure?

- Perhaps the most frequent use of spinal CT is to detect—or rule out—spinal column damage in patients who have been injured.
- CT is a very helpful means of evaluating the spine before and after surgery.
- CT scanning is able to detect various types of tumor in the vertebral column, including those that have spread there from another area of the body. Some

tumors that arise elsewhere are first identified by finding deposits of malignant cells (metastases) in the vertebrae; prostate cancer is an example.

- In patients with narrowing of the spinal canal, vertebral fracture, infection or degenerative disease such as arthritis, CT of the spine may provide important information when carried out by itself or in addition to magnetic resonance imaging (MRI). One of the most common causes of spinal pain that may be diagnosed by CT is a herniated intervertebral disk.
- When a patient is at risk of osteoporosis, CT can accurately measure bone density in the spine and predict whether vertebral fractures are likely to occur.
- CT is a valuable means of guiding certain diagnostic procedures such as the biopsy of a suspicious area to detect cancer, or the removal of fluid from a localized infection (abscess).

How should I prepare for the CAT scan?

You should wear comfortable, loose-fitting clothing to the imaging center, where you will be given a hospital gown to put on. Metal objects including jewelry, eyeglasses, dentures, hairpins and the like may affect the CT images and should be removed. You may be asked not to eat or drink anything for several hours beforehand, especially if you are to receive contrast material by mouth or by injection. You should tell the physician and radiology staff if you have a history of allergic reactions—especially to iodine, which is often present in contrast material. They also should know if you have a history of heart disease, asthma, diabetes or thyroid problems. Any of these conditions may increase the risk of an allergic reaction. You may be asked to sign a consent form before the examination.

If your infant or young child is to have spinal CT, there are measures that can be taken to ensure that the test will go smoothly and will not be a cause of anxiety for either the child or parent. A woman of reproductive age should inform her physician or the x-ray technologist if there is any possibility that she is pregnant.

What does the equipment look like?

The CT scanner is a large unit with a hole, or tunnel, running directly through its center. The patient lies on a table that can be moved up or down and that slides into and out of the center of the tunnel. The technologist will be in an adjoining room to watch you through an observation window and by video camera throughout the procedure. In addition, there is an intercom system through which you can communicate with the technologist.



How does the procedure work?

When x-rays are beamed through the body, some are absorbed while the rest pass through to produce an image. For conventional x-rays, a film absorbs those x-rays that have penetrated the patient's body. In CT scanning, a source of x-rays and a set of electronic x-ray detectors rotate around the patient. The detectors absorb penetrated x-rays and measure their amount. Because the x-ray source rotates about the patient and, at the same time, the examination table advances through the scanner, the x-ray beam follows a spiral path, giving rise to the term "spiral" (or "helical") CT. The information collected by the detectors is sent to a computer system that processes it and reconstructs two-dimensional cross-sectional images (the "slices") that depict the interior of the body. A single slice is recorded in only a few seconds. The CT images represent the density of different tissues. More dense tissues such as bone appear white, whereas less dense tissues such as the spinal cord

appear in shades of gray. The spinal canal contains the gray spinal cord and the very dark cerebrospinal fluid.

Modern spiral CT units produce high-quality images in a short time, making it a convenient study for children and patients who are critically ill. It now is possible to image large areas of the body such as the spinal column in just minutes. It also is possible with modern equipment to combine multiple CT images so as to produce a three-dimensional display.

How is the CAT scan performed?

Spinal CT scanning is carried out with the patient lying on his or her back. The technologist will make sure that you are properly positioned and may use pillows to help you maintain a correct posture during the study. If indicated, a contrast material will be injected into an arm vein during the procedure so as to sharpen the images of various tissues. A scan of the lower spine may also be done after injecting contrast material into the spinal canal (usually well below the bottom of the spinal cord) during a lumbar puncture. This will help to detect tumors or locate areas of inflammation or nerve compression. Initially the table will move rapidly through the scanner to determine the correct starting position. Further scans then are made as the table moves more slowly through the tunnel in the scanner.

The actual imaging takes only a very short time and a complete exam, including set-up time, takes from five to 30 minutes. When the exam is completed, you may have to wait a short time while the radiologist, a physician specially trained to obtain and interpret medical images, checks the images to be sure that they are of high enough quality to be correctly interpreted. If necessary, a few additional scans will be obtained. Less patient movement during the procedure produces clearer CT images.

What will I experience during the procedure?

Spinal CT scanning is a painless procedure, apart from a needle stick if an intravenous injection is needed. Discomfort comes mainly from having to lie still on the table for some time. Injection of contrast material may cause a slight burning feeling in the arm, a metallic taste and warm flushing of the entire body. These all are normal reactions and usually end within a few seconds. Patients who have a hard time remaining still or who are claustrophobic may find CT to be stressful. The same may be the case for those who have chronic pain. If you are one of these patients, the technologist may give you a mild sedative to help get you through the exam.

Who interprets the results and how do I get them?

A radiologist trained to interpret CT images will review the findings and make a detailed report to your primary care physician. Your doctor's office will let you know when the results are in and how to obtain them. Having had a spinal CT study, you and your doctor will be better able to decide on further diagnostic procedures or treatment.

What are the benefits vs. risks?

Benefits

- Spinal CT scanning is a rapid procedure and offers an accurate evaluation of bone and most soft tissues. Using the latest equipment, the spine may be displayed in multiple planes and three-dimensional imaging is an option.
- CT is able to depict internal bleeding and fractures in trauma victims shortly after they arrive at the hospital.
- CT scans of the spine are non-invasive and cause no pain.
- CT is less expensive and more cost-effective than MRI. In addition, it is less sensitive to patient movement. Unlike MRI, CT may be carried out in patients who have an implanted device of any kind.
- CT imaging can help guide a biopsy needle when taking a tissue sample and can aid the removal of fluid or drainage of an abscess.

Risks

- Like all x-ray procedures, CT scanning involves exposure to potentially harmful radiation. Radiation doses are lower than those used in some general x-ray exams but higher than in others. Damaging effects of radiation may be more of a risk when multiple CT studies are carried out over a period of time.
- Women should always inform their doctor or x-ray technologist if there is any possibility that they are pregnant.
- Children should have a CT study only if it is essential for making a diagnosis. In general, the benefits of CT scanning outweigh the potential harm from radiation.
- Iodine-containing contrast material may cause a brief allergic reaction such as itching, hives, nausea

or rapid breathing, which is easily treated. Severe reactions including difficulty breathing are quite rare but do occur. Kidney failure is another very rare occurrence; it is likeliest to develop in patients whose kidney function already is impaired.

- Nursing mothers should avoid breast-feeding their infants for 24 hours after receiving an injection of contrast medium.

What are the limitations of CT Scanning of the Spine?

- Spinal CT does not consistently show enough detail to properly assess the spinal cord. MRI is also more suitable than CT for demonstrating injured ligaments, the status of the intervertebral disks and hematomas in the area of the spine.
- CT scanning fails to identify some vertebral fractures that are not displaced.
- Contrast material must sometimes be injected to obtain clear images of blood vessels, tumor tissue, muscle and fluid.
- CT scanning is, in general, not recommended for pregnant women. Young children should not have repeated CT studies unless absolutely necessary.

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