



# Guide to CT Scans

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# What is CT?

Computed tomography (commonly known as a CT or CAT scan) is a valuable diagnostic tool that ranks among the top medical achievements of the 20th century. While it uses X-rays, CT imaging is an improvement over traditional X-ray exams because it eliminates from the images overlapping structures in the body that can obscure the area of concern and make diagnosis difficult. During CT imaging, the X-ray tube rotates around the patient, capturing multiple images from different angles. A computer is then used to synthesize these images to create unobstructed views of the structures of interest.



## Why have a CT scan?

### **MANY DIFFERENT TYPES OF SYMPTOMS AND CONCERNS CAN WARRANT A CT SCAN**

It allows doctors to derive detailed information in high-resolution images from a non-invasive procedure, sometimes eliminating the need for exploratory surgery or surgical biopsy. CT is particularly useful for examining skeletal structures and is capable of imaging bone, soft tissue, and blood vessels all at the same time. CT can aid in cancer staging as well as empower surgeons to determine the exact size and location of tumors before removal.

### **ALTHOUGH MRI CAN OFFER SOME OF THE SAME BENEFITS, CT IMAGING HAS SOME DISTINCT ADVANTAGES OVER MRI IN CERTAIN SITUATIONS:**

- CT is much faster than MRI. This makes it preferable in emergencies, especially when checking for internal injuries following an accident.
- The speed of CT imaging makes it an easier test for claustrophobic patients to endure.
- CT is less sensitive to movement than MRI, making it easier to obtain clear images.
- Unlike MRI, CT can be performed on patients with implanted medical devices.

# What are the risks of CT scanning?

The small risk involved in CT scanning stems primarily from the use of ionizing radiation and the contrast material that is sometimes necessary to produce the most informative images.

## IONIZING RADIATION

Because CT is an X-ray exam, it utilizes ionizing radiation, which is associated with an increased cancer risk. We are all exposed to small amounts of radiation every day, however, from natural sources such as sunlight. In fact, it is currently estimated that the average person in the U.S. receives 3 mSv of radiation annually through natural sources. This means that a CT scan of the chest, which delivers approximately 6.1 mSv of radiation, has a similar effect on one's radiation exposure as living two years on the earth.<sup>1</sup>

Scientists were first able to establish the link between cancer and radiation dose by observing survivors of the nuclear blasts in Hiroshima and Nagasaki. Based on these observations, researchers developed hypotheses about the increased cancer risk that accompanies various doses of ionizing radiation using what's known as the linear no-threshold (LNT) model. The LNT model presumes that cancer risk increases with even the smallest dose of radiation.<sup>2</sup> Using this model, the FDA estimates that 10 millisieverts (mSv) of radiation is associated with a .0005% increased lifetime risk of dying from cancer.<sup>3</sup>

When a CT scan is recommended, this presumed risk is outweighed by the value of the information obtainable from the scan, which can allow doctors to diagnose and treat issues that are much riskier and more immediate. Many researchers today, however, assert that the LNT model is flawed.<sup>4</sup> They propose that the low doses of radiation involved in medical imaging do not increase a patient's cancer risk and may even have a protective effect known as hormesis.<sup>5</sup> Nonetheless, medical professionals continue to be guided by the principle of ALARA ("as low as reasonably necessary") when it comes to ionizing radiation. This means medical imaging should deliver the lowest dose of radiation needed to gather the information necessary to care for the patient's health needs.

## CONTRAST MATERIAL

The most common contrast materials used in CT scanning contain iodine. When iodine-containing contrast is injected, it often causes a warm flush and a metallic taste, which typically dissipate quickly and leave no lasting effects. After the procedure, patients are often advised to consume extra fluids to help flush the contrast from the body.

Potential reactions to iodine-containing contrast range from mild to severe. Be sure to tell your doctor if you have a known allergy to iodine. Sensitive patients may experience hives, itching, headache, or nausea and vomiting after receiving iodine-containing contrast material. More severe allergic reactions may cause breathing difficulties, abnormal blood pressure or heart rhythms, or swelling of the throat or other body parts.<sup>6</sup> If you experience any ill effects after receiving a contrast dye or any other medication, let your provider know right away.

## MINIMIZING RISK

To minimize risks involved with ionizing radiation, CT facilities and providers must follow approved safety protocols and undergo specified training. In recommending CT, practitioners are required to follow guidelines designed to ensure that CT technology is used sparingly and only when necessary to answer an important clinical question. Iowa Radiology uses dose-reducing software to achieve the best quality images with the lowest possible radiation dose.

# CT Colonography (Virtual Colonoscopy)



## What is CT colonography?

CT colonography, also known as “virtual colonoscopy,” is a minimally invasive alternative to traditional colonoscopy that uses CT instead of a camera inserted into the body to screen for polyps and other lesions in the large intestine. Because of its minimally invasive nature, CT colonography has a lower risk of complications, such as perforation of the colon, than traditional colonoscopy, and patients undergoing CT colonography generally do not require sedation, which is typically used in traditional colonoscopy.<sup>7</sup>

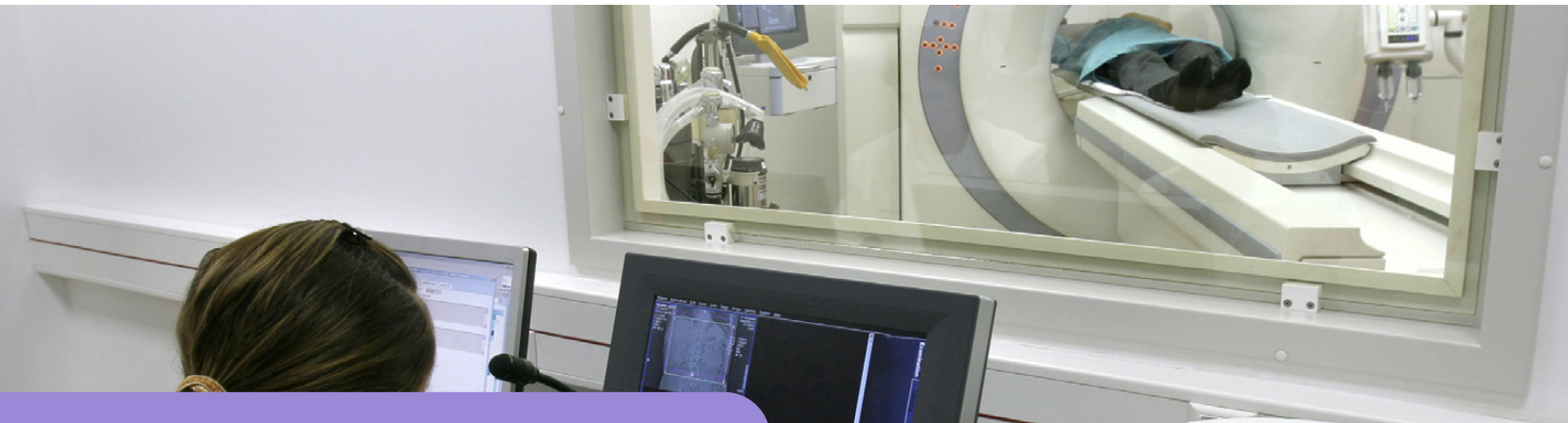
### WHAT CAN I EXPECT DURING THE PROCEDURE?

Just as with a traditional colonoscopy, the bowel must be cleansed prior to the procedure. You will be asked to begin a bowel cleansing regimen two days before your exam. If you have heart, kidney, or liver disease, make sure to inform your doctor before beginning the cleansing regimen.

When you arrive in the exam room for your appointment, you will change into a gown, and the technologist will take your medical history. You will then lie on your left side, and a very small, flexible tube will be inserted just two inches inside the rectum. The colon will be filled with carbon dioxide to expand the area and allow for full visualization. The carbon dioxide gas may cause discomfort similar to naturally occurring intestinal gas. Images will be taken while you lie on your back and then on your belly. The entire exam takes approximately 30 minutes.

After the test, you can resume your regular activities. Discomfort from the excess CO<sub>2</sub> gas will fade as the body quickly absorbs it. The radiologist will review the images and send a report to the referring physician within one business day. CT colonography is only a diagnostic procedure, however. If polyp removal is needed, this will require a traditional colonoscopy.

# CT Cardiac Calcium Scoring



## What is CT cardiac calcium scoring?

CT cardiac calcium scoring is a quick, painless, and low-risk procedure that uses a CT scan of the heart to look for and determine the extent of calcified plaque in the coronary arteries (the vessels that supply oxygen-containing blood to the heart) in order to assess a patient's risk of coronary artery disease. The level of plaque buildup found is expressed in a calcium score:

- A score of 0 indicates no buildup or evidence of coronary artery disease (CAD);
- 1-10 shows minimal evidence of CAD;
- 11-100 indicates mild evidence of CAD;
- Scores between 101 and 400 indicate moderate evidence of CAD;
- A score over 400 indicates extensive of CAD.<sup>11</sup>

Cardiac calcium scoring can detect plaque buildup before symptoms of CAD appear, providing the opportunity to treat the disease proactively and prevent further damage.

## WHO SHOULD CONSIDER THE TEST?

If you have risk factors for coronary artery disease, your physician may recommend cardiac calcium scoring to more precisely assess your personal risk. Common risk factors include

- Family history of CAD
- High LDL cholesterol
- High blood pressure
- Obesity
- Tobacco smoking
- Diabetes
- Physical inactivity

If one or more of these apply to you, ask your doctor if cardiac calcium scoring would be advisable for you.

## WHAT SHOULD I EXPECT DURING THE PROCEDURE?

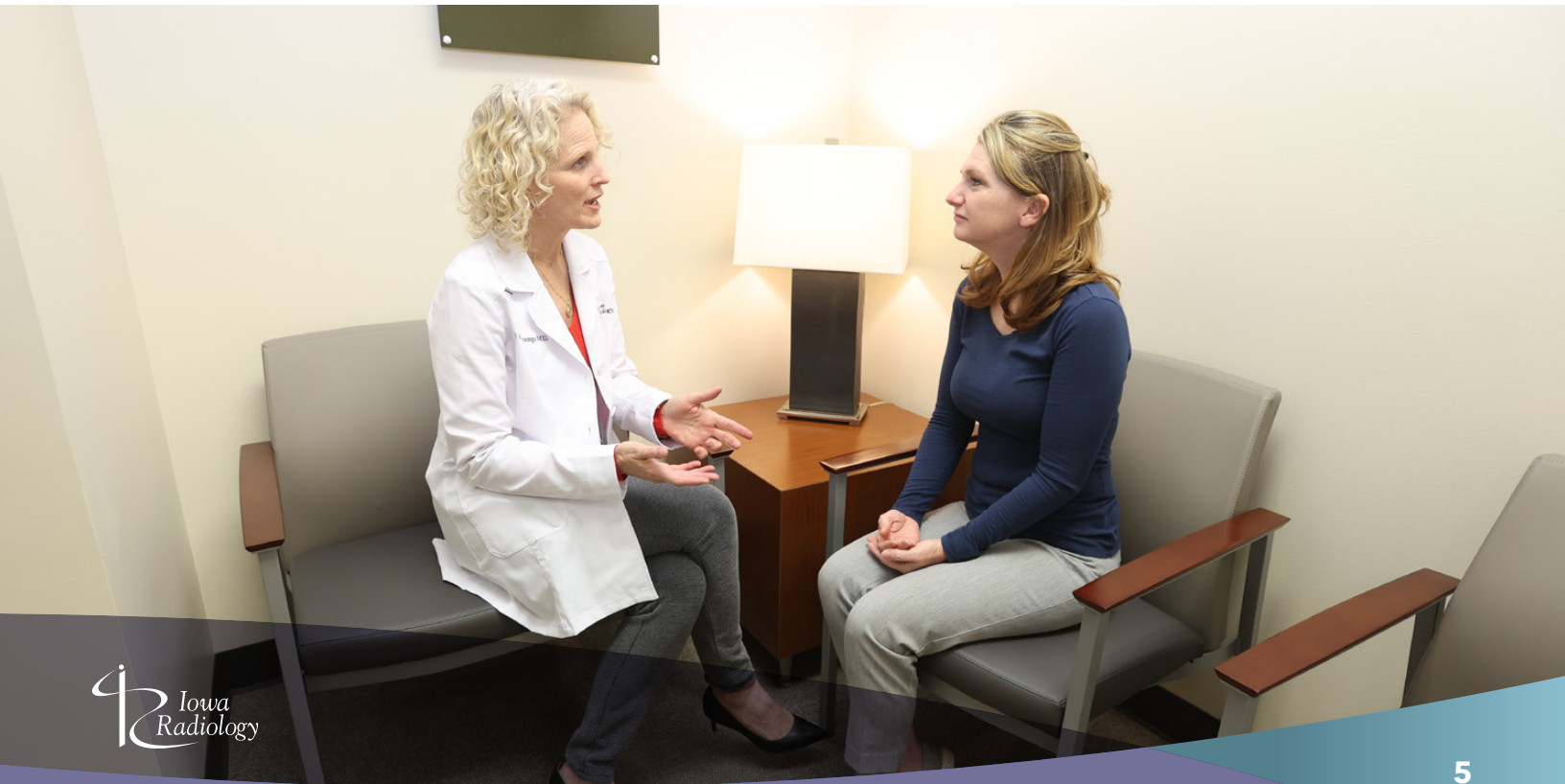
When you come in for your exam, you will be asked to change into a gown and remove any jewelry. To begin the test, the technologist will position you on your back on the CT exam table. No contrast material is needed for this test. Electrodes will be attached to your chest and an electrocardiograph so your heart rate can be monitored throughout the procedure.

To capture images, the exam table will move through the CT machine. You will be asked to lie very still and to hold your breath for 10-20 seconds at a time so the technician can get clear images. The entire exam should be complete within about 20 minutes. You can resume your regular activities immediately following the test. The radiologist will review the images and send a report to your referring physician within one business day.

# CT at Iowa Radiology

CT is an invaluable imaging tool that can aid in the diagnosis of a broad range of conditions. Any CT scan done at Iowa Radiology will be ordered by your doctor, who knows your history best and will weigh the risks against the benefits of having a CT scan. If your doctor has ordered a CT scan or recommended CT screening for conditions such as colon cancer or coronary artery disease, feel free to contact us at Iowa Radiology. We provide a wide range of CT tests in a safe, patient-centered environment. Our CT services include

- Routine head
- Mastoids, orbits, ear
- Sinus/facial bones
- Soft tissue neck
- Routine chest
- Cardiac calcium score
- Virtual colonoscopy
- Low-dose CT lung screening
- Abdomen/pelvis
- Upper extremity
- Lower extremity
- CT angiography
  - Abdomen/pelvis
  - Brain
  - Carotids
  - Chest
  - Coronary





In Partnership With



## Our focus is your good health!

We strive to provide both the best patient care and the best customer service possible. If you ever have any questions or concerns about an exam at one of our clinics, feel free to give us a call.

Contact Iowa Radiology Today!

# Endnotes

<sup>1</sup> Radiological Society of North America. Radiation Dose in X-Ray and CT Exams. Radiologyinfo.org. Reviewed November 21, 2022. Accessed January 22, 2024. <https://www.radiologyinfo.org/en/info/safety-xray>, 2022.

<sup>2</sup> Cardarelli II, J, Calabrese, J, Burk, B, et al. Rethinking a tenet of cancer risk assessment for low radiation doses. Research Outreach. 2023;137. <https://dx.doi.org/10.32907/RO-137-4997203759>.

<sup>3</sup> American Cancer Society. Do X-rays and Gamma Rays Cause Cancer? Revised November 10, 2022. Accessed January 22, 2024. <https://www.cancer.org/cancer/risk-prevention/radiation-exposure/x-rays-gamma-rays/do-xrays-and-gamma-rays-cause-cancer.html>.

<sup>4</sup> Iavicoli I, Fontana L, Santocono C, et al. The challenges of defining hormesis in epidemiological studies: The case of radiation hormesis. Sci Total Environ. 2023 Dec 1;902:166030. <https://dx.doi.org/10.1016/j.scitotenv.2023.166030>.

<sup>5</sup> Doss M. Linear No-Threshold Model vs. Radiation Hormesis. Dose-Response. 2013;11(4):480-97. <https://dx.doi.org/10.2203/dose-response.13-005.Doss>.

<sup>6</sup> Contrast Materials. RadiologyInfo.org. Reviewed December 6, 2022. Accessed January 22, 2024. <https://www.radiologyinfo.org/en/info/safety-contrast>.

<sup>7</sup> Radiological Society of North America. CT Colonography. RadiologyInfo.org. [https://www.radiologyinfo.org/en/info/ct\\_colo](https://www.radiologyinfo.org/en/info/ct_colo). Reviewed November 1, 2022. Accessed January 22, 2024.

<sup>8</sup> Radiological Society of North America. Cardiac CT for Calcium Scoring. RadiologyInfo.org. Reviewed April 15, 2022. Accessed January 22, 2024. [https://www.radiologyinfo.org/en/info/ct\\_calscoring](https://www.radiologyinfo.org/en/info/ct_calscoring).