

## Parathyroid 4DCT Scan

Parathyroid four-dimensional computed tomography (4DCT) is a technique that uses sophisticated x-ray technology to locate the parathyroid glands in the neck. CT scanning is fast, painless, noninvasive and accurate. Parathyroid 4DCT is a more specialized CT scan with greater ability to locate diseased glands. This may lead to better treatment results.

Tell your doctor if there is a possibility you are pregnant and discuss any recent illnesses, medical conditions, medications you're taking, and allergies. You will be told not to eat or drink anything for a few hours before your exam. If you have a known allergy to contrast material, your doctor may prescribe medications to reduce the risk of an allergic reaction. Leave jewelry at home and wear loose, comfortable clothing. You may need to wear a gown.



### What is a parathyroid 4DCT scan?

Four-dimensional parathyroid computed tomography (4DCT) is an advanced method for detecting enlarged parathyroid glands in the neck.

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. The cross-sectional images generated during a CT scan can be reformatted in multiple planes. They can even generate three-dimensional images.

In 4DCT, time represents the fourth dimension of the image. Contrast material is given at specific rates and images are taken at specific times. This gives a clearer picture and better distinguishes abnormal tissue from normal tissue.

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

A 4DCT exam is used to identify enlarged parathyroid glands and plan surgery. It is a very sensitive study with better resolution than any other diagnostic study utilized for the detection of the parathyroid glands. This study is particularly useful in cases where the other diagnostic tests such as ultrasound and nuclear medicine scans have been negative, or with more complicated cases such as history of prior surgery or recurrent parathyroid disease.

The parathyroid glands are four pea-sized glands located behind or near the thyroid gland in the neck. The glands produce parathyroid hormone (PTH). This hormone helps maintain the correct balance of calcium in the body. When one or more of the glands is diseased, the body may have abnormal levels of calcium. This can lead to health problems like kidney stones, heart abnormalities and loss of bone over time.

Parathyroid disease can affect one or more of the parathyroid glands. Treatment often involves removal of the diseased glands. Locating the abnormal gland(s) can be very difficult. Doctors most often use ultrasound or nuclear medicine imaging. If neither of these methods is effective, 4DCT may be used.

A 4DCT scan is also used to help plan for parathyroid surgery. This may allow the doctor to avoid more invasive surgery and reduce the risk of complications.

## 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 CT Safety During Pregnancy (<https://www.radiologyinfo.org/en/info/safety-ct-pregnancy>) page for more information.*

## 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.

## 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.

For parathyroid 4DCT, you will be positioned to minimize interference from structures near the parathyroid glands. These include teeth, jaws, and dental fillings as well as shoulder and collar bones.

You will be given contrast material through an intravenous catheter (IV). A specific volume of contrast is given at a specific rate. After contrast is given, the CT scanner will spin around you in a corkscrew pattern and take pictures. The images are acquired at very specific times as the contrast material is taken up by the parathyroid glands.

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.

A parathyroid CT scan takes about five minutes to perform. The entire procedure—including prep time—takes about an hour.

## **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.

## **What are the benefits vs. risks?**

### **Benefits:**

- Parathyroid 4DCT has a greater ability to locate diseased glands. This may lead to better treatment results.

- Parathyroid 4DCT has a higher image resolution than any other type of parathyroid scan.
- Parathyroid 4DCT is particularly useful when other imaging studies have failed to identify the abnormal parathyroid gland.
- By determining the precise location of the enlarged parathyroid gland, 4DCT can help avoid more invasive surgery and its associated complications.
- Parathyroid 4DCT can make re-operative surgery both faster and more successful. This is particularly true in challenging cases where multiple abnormal parathyroid glands are causing the disease.

## Risks

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.

Patients undergoing 4DCT scan do receive a larger amount of radiation compared to a routine neck CT.

While there is no conclusive evidence that the small doses of radiation delivered by a CT scan cause cancer, large population studies have shown a slight increase in cancer from much larger amounts of radiation, such as from radiation therapy. Thus, there is always concern that this risk may apply to the amounts of radiation delivered by a 4DCT exam. When your doctor recommends a 4DCT, the expected benefit of the test outweighs the potential risk from radiation. Discuss the benefits versus the risks of your 4DCT scan with your doctor or radiologist. Ask whether other imaging tests may be used to diagnose your condition.

- The radiation dose for this procedure varies. *See the Radiation Dose (<https://www.radiologyinfo.org/en/info/safety-xray>) page for more information.*
- Women should always tell their doctor and x-ray or CT technologist if there is any chance they are pregnant. *See the Radiation Safety (<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.
- IV contrast manufacturers indicate mothers should not breastfeed their babies for 24-48 hours after contrast material is given. However, the most recent American College of Radiology (ACR) Manual on Contrast Media reports that studies show the amount of contrast absorbed by the infant during breastfeeding is extremely low. *For further information please consult the ACR Manual on Contrast Media (<https://www.acr.org/Clinical-Resources/Contrast-Manual>) and its references.*

## What are the limitations of a parathyroid 4DCT scan?

Patients with impaired kidney (renal) function should be given special consideration before receiving iodine-based contrast materials by vein or artery. Such patients are at risk for developing contrast-induced nephropathy (CIN), a condition in which already-impaired kidney function worsens within a few days of contrast material administration. Much of the research linking CIN with iodine-based contrast material is based on older contrast agents that are no longer used. Some recent studies have found no increased risk of CIN in patients who received iodine-based contrast material. If you have impaired kidney function, your doctor will weigh the benefits of contrast-enhanced CT against any risks.

## 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 © 2025 Radiological Society of North America, Inc.