

Coronary Computed Tomography Angiography (CTA)

This information 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 Coronary CTA?

Coronary computed tomography angiography (CTA) is a heart imaging test that helps determine if fatty or calcium deposits have narrowed a patient's coronary arteries. Coronary CTA is a special type of x-ray examination. Patients undergoing a coronary CTA scan receive an iodine-containing contrast material as an intravenous (IV) injection to ensure the best possible images.

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

CT imaging combines special x-ray equipment with sophisticated computers to produce multiple images or pictures of the inside of the body. These cross-sectional images of the area being studied can then be examined on a computer monitor or printed.

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

What are some common uses of the procedure?

Many physicians advocate the careful use of coronary CTA for patients who have:

- presented themselves in the emergency room with chest pain.
- suspected abnormal coronary arteries.
- low to intermediate risk for coronary artery disease, but have symptoms such as chest pain which are not brought on by physical activity.
- unclear or inconclusive stress test results.

- intermediate to high-risk for coronary artery disease, but who do not have typical symptoms like chest pain, shortness of breath, or fatigue during heavy physical activity.

For these patients, coronary CTA can provide important insights into the extent and nature of plaque formation with or without narrowing of the coronary arteries. Coronary CTA can also exclude narrowing of the arteries as the cause of chest discomfort and detect other possible causes of symptoms. Your primary care physician, possibly in consultation with a radiologist who would perform the test, will determine whether coronary CTA is appropriate for you.

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 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. If you have a known allergy to contrast material, or “dye,” your doctor may prescribe medications to reduce the risk of an allergic reaction.

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.

On the day before and day of your exam, you may be asked to avoid:

- caffeinated drinks such as coffee, tea, energy drinks, or sodas.
- diet pills.
- Viagra or any similar medication. It is not compatible with the medications you will receive during the procedure.

One the night before the procedure, you may be asked to take a beta blocker medication to lower your heart rate.

Ask your doctor if you have questions about the instructions given to you.

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

If you are breastfeeding at the time of the exam, you should ask your radiologist how to proceed. It may help to pump breast milk ahead of time and keep it on hand for use after contrast material has cleared from your body, about 24 hours after the test.

What does the equipment look like?

The CT scanner is typically a large, box-like machine with a hole, or short tunnel, in the center. You will lie on a narrow examination table that slides into and out of this 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 located in a separate room, where the technologist operates the scanner and monitors your examination.

Coronary CTA is very much like a normal CT scan. The only difference is the speed of the scanner and the heart monitor hook-up.

How does the procedure work?

During the examination, x-rays pass through the body and are picked up by special detectors in the scanner. Typically, higher numbers (especially 16 or more) of these detectors result in clearer final images. For that reason, coronary CTA often is referred to as “multi-detector” or “multi-slice” CT scanning. The information collected during the coronary CTA examination is used to identify the coronary arteries and, if present, plaques

in their walls with the creation of three-dimensional images on a computer screen.

When a contrast material is introduced to the bloodstream during the procedure, it clearly defines the blood vessels being examined by making them appear bright white.

How is the procedure performed?

You will be given a gown to wear during the procedure.

A nurse will insert an intravenous (IV) line into a vein in your arm to administer contrast material (dye) during your procedure. You may be given beta blocker medication through the same IV line or orally. Your IV line may also be used to administer nitroglycerin, which will dilate your vessels for better visualization of the coronary arteries. You will lie on a special scanning table.

The technologist will clean three small areas of your chest and place small, sticky electrode patches on these areas. Men can expect to have their chest partially shaved to help the electrodes stick. The electrodes are attached to an electrocardiograph (ECG) monitor, which charts your heart’s electrical activity during the test.

While lying on the scanning table, you may be asked to raise your arms over your head for the duration of the exam.

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.

Inform your doctor if you have problems in holding your breath for 10 to 15 seconds. Breathing during the scan creates artifacts on the images.

When the examination is completed, you will be asked to wait until the technologist verifies that the images are of high enough quality for accurate interpretation.

Your intravenous line will be removed.

Including all preparations, the coronary CTA scan takes about 15 minutes.

What will I experience during and after the procedure?

Most CT exams are painless, fast and easy. With coronary CTA, 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, under the direction of a physician, may offer you a mild sedative to help you tolerate the CT scanning procedure.

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. A radiologist or other physician will be available for immediate assistance.

The medication given to slow the heart rate has been known to cause some patients to feel dizzy when they stand suddenly. The dizziness is slight and only happens rarely.

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.

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

Who interprets the results and how will I get them?

A physician, usually a radiologist with expertise in supervising and interpreting radiology examinations, will analyze the images and send a signed report to your primary care or referring physician, who will discuss the results with you.

If you are actively having chest pain, your results will be given to the emergency room doctor, and a preliminary result will be reported right away.

What are the benefits vs. risks?

Benefits

- Coronary CTA is noninvasive. Coronary angiograms and cardiac catheterization are more invasive, have more complications related to the vascular access into an artery and the manipulation of a catheter, and require more patient recovery time than coronary CTA.
- A major advantage of CT is that it is able to image bone, soft tissue and blood vessels all at the same time. It is therefore suited to identify other reasons for your discomfort such as an injury to the aorta or an embolus in the lungs.
- Unlike conventional x-rays, CT scanning provides very detailed images of many types of tissue.
- CT examinations are fast and simple.
- CT has been shown to be a cost-effective imaging tool for a wide range of clinical problems.
- CT is less sensitive to patient movement than MRI.
- CT can be performed if you have an implanted medical device of any kind, unlike MRI.
- No radiation remains in a patient's body after a CT examination.
- X-rays used in CT scans usually have no side effects.
- Angiography may eliminate the need for surgery. If surgery remains necessary, it can be performed more accurately.

Risks

- There is always a slight chance of cancer from excessive exposure to radiation. However, the benefit of an accurate diagnosis far outweighs the risk.
- The effective radiation dose from this procedure is about 3 mSv with 16- and 64-slice CT, respectively, which is about the same as the average person receives from background radiation in two to four years.
- Women should always inform their physician and x-ray or CT technologist if there is any possibility that they are pregnant.
- CT scanning is, in general, not recommended for pregnant women unless medically necessary 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 extremely rare, and radiology departments are well-equipped to deal with them.

What are the limitations of coronary CTA?

A person who is very large may not fit into the opening of a conventional CT scanner or may be over the weight limit for the moving table.

Patients who are extremely overweight or who have abnormal heart rhythms also tend not to be suitable candidates for this test because imaging quality is compromised.

Although coronary CTA examinations are growing in use, coronary angiograms remain the preferred method for detecting coronary artery stenosis, which is a significant narrowing of an artery that could require catheter-based intervention (such as stenting) or surgery (such as bypassing). Unlike CTA which is only a diagnostic test, coronary angiography can provide both diagnosis and treatment in a single session. Patients with a high likelihood of coronary artery disease and typical symptoms should therefore directly undergo coronary angiography.

Coronary CTA also is of limited use in patients with extensive areas of old, calcified (hardened) plaque, which is often the case in older patients.

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