Coronary Computed Tomography Angiography (CTA)

What is Coronary CTA?

Coronary computed tomography angiography (CTA) is a heart imaging test that helps determine if deposits of fat or calcium (plaque) 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 (dye) 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 scanning 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, printed or transferred to a CD.

CT scans of internal organs, bones, 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:

- chest pain and have come to the emergency room.
- suspected abnormal anatomy of the coronary arteries.
- low or medium risk for coronary artery disease, but have symptoms such as chest pain not brought on by physical activity.
- medium or 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.
- unclear or inconclusive stress test results.
- new onset heart failure with reduced left ventricle function.
- medium risk of coronary artery disease, before non-coronary cardiac surgery.
- symptoms associated with coronary artery bypass grafts.

For these types of patients, coronary CTA can provide important information about the extent and type of fat and calcium deposits in the coronary arteries. Coronary CTA can also evaluate narrowing of the arteries as the cause of chest discomfort, and it can detect other possible causes of symptoms, such as a

collapsed lung or blood clot in blood vessels leading to the lungs. 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 a contrast material will be used in your exam. You should inform your physician of all 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 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 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

On 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. See the Safety page (www.RadiologyInfo.org/en/safety/) for more information about pregnancy and x-rays.

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 control 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 CT 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 64 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 possible areas of narrowing and plaque in the coronary artery walls. The computer is used to create three-dimensional images of the heart and coronary arteries.

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 a beta blocker medication through the same IV line or orally to help slow your heart rate in order to improve image quality. Nitroglycerin, which will dilate your coronary arteries for better visualization, may also be administered as a pill or tablet underneath your tongue. 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 may 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. Depending on the type of CT scan, the machine may make several passes.

You may be asked to hold your breath during the scanning. Any motion, whether breathing or body movements, can lead to artifacts on the images. This is similar to the blurring seen on a photograph taken of a moving object.

Inform your doctor if you have problems in holding your breath for 10 to 15 seconds. Breathing during the scan creates blurring on the images and can result in an inconclusive exam.

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?

Other than the needle stick when the IV line is placed, most CT exams are fast, easy and painless.

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 some medication to help you tolerate the CT scanning procedure.

If an intravenous contrast material is used, you will feel a 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. Some patients may experience a sensation like they have to urinate but this subsides quickly.

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 light lines may be seen on your body and are 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, unless there are special circumstances. However, the technologist will always 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 do 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 physician or the physician who referred you for the exam, 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.

Follow-up examinations are often necessary, and your doctor will explain the exact reason why another exam is requested. Sometimes a follow-up exam is done because a suspicious or questionable finding needs clarification with additional views or a special imaging technique. A follow-up examination may be necessary so that any change in a known abnormality can be detected over time. Follow-up examinations are sometimes the best way to see if treatment is working or if an abnormality is stable over time.

What are the benefits vs. risks?

Benefits

- Coronary CTA is not invasive. An alternative test, cardiac catheterization with a coronary angiogram, is more invasive, has more complications related to the placement of a long catheter into an artery and the movement of the catheter in the blood vessels, and requires more time for the patient to recover.
- A major advantage of CT is that it is able to view 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 a blood clot 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 cost-effective for a wide range of medical 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 immediate 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 for this procedure varies. See the Safety page (www.RadiologyInfo.org/en/safety/) for more information about radiation dose.
- Women should always inform their physician and x-ray or CT technologist if there is any possibility that they are pregnant. See the Safety page (www.RadiologyInfo.org/en/safety/) for more information about pregnancy and x-rays.
- 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 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—usually 450 pounds—for the moving table.

Patients who are extremely overweight or who have abnormal heart rhythms are usually not good candidates for this test because image quality may be compromised.

Although coronary CTA examinations are growing in use, coronary angiography is still the main

method for detecting coronary artery stenosis, which is a significant narrowing of an artery that could require treatment such as a stent or bypass surgery. Unlike CTA, which is only a diagnostic test, coronary angiography can be used for both diagnosis and treatment in a single session. Patients with a high risk of coronary artery disease and typical symptoms might undergo coronary angiography instead of CTA.

Coronary CTA is often not useful in patients with many areas of old, calcified (hardened) plaque, which is often the case in older patients.