

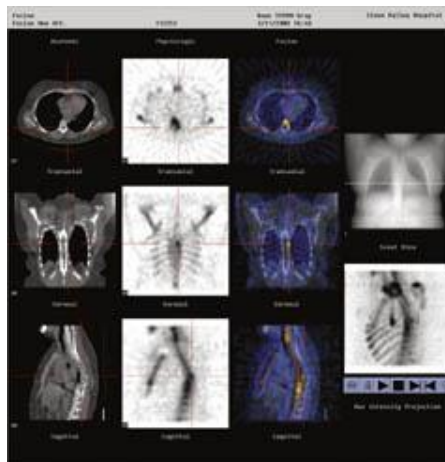
Cardiac Nuclear Medicine

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What is Cardiac Nuclear Medicine?

Nuclear medicine is a healthcare specialty involving the use of radioactive compounds to perform diagnostic imaging examinations that can lead to the effective treatment of many diseases. Although nuclear medicine is often considered an independent discipline, it is closely related to radiology in that radiation is used to develop images of human anatomy.

Cardiac nuclear medicine refers to these diagnostic tests that are used to examine the anatomy and function of the heart.



Nuclear camera scans.

What are some common uses of Cardiac Nuclear Medicine?

Cardiac nuclear medicine tests are indicated for individuals with unexplained chest pain or chest pain brought on by exercise (called angina) to permit the early detection of heart disease.

The most common cardiac nuclear medicine procedure, called myocardial perfusion scanning, enables the visualization of blood-flow patterns to the heart walls. The test is important for evaluating the presence and extent of suspected or known coronary artery disease (blockages) as well as the results of previous injury to the heart from a heart attack, called a myocardial infarction. It also can be done to evaluate the results of bypass surgery or other percutaneous revascularization procedures designed to restore the blood supply to the heart.

Heart-wall movement and overall heart function can be evaluated with cardiac gating, a technique that synchronizes the images of the heart with different parts of the cardiac cycle (contracting or relaxing) as determined by an electrocardiogram (ECG), which records the electrical currents that activate the heart muscle and cause it to pump.

How should I prepare for my Cardiac Nuclear Medicine procedure?

You should avoid caffeine (coffee, tea, etc.) and smoking for 48 hours before the examination. You should not eat or drink anything after midnight before the procedure, but continue taking medications with small amounts of water unless your physician says otherwise. Wear comfortable, walking shoes and loose-fitting clothes for your procedure. Tell the technologist and supervising physician if you have asthma or a chronic lung disease or have problems with your knees, hips or keeping your balance, which may limit your ability to perform the exercise needed for this procedure.

What does the Cardiac Nuclear Medicine equipment look like?

The imaging equipment, called a gamma camera or scintillation camera, consists of specialized detectors enclosed within a metal housing. The detector portion of the camera can be changed to a variety of positions to obtain images of the body from different directions. A nearby computer console, possibly in another room, is used to develop the images of the heart.



Nuclear camera scan of chest in progress.

How does the Cardiac Nuclear Medicine procedure work?

Coronary arteries are best evaluated by determining the changes in blood flow to the heart due to exercising. Consequently, you will undergo a stress test—most commonly through physical exercise—to make your heart work harder than normal. Then you will be given a radioactive compound, called a radiopharmaceutical agent or tracer. This compound will collect in parts of your heart with good blood flow and will give off gamma rays. The gamma camera detects the rays. Subsequently, a computer following a set of complicated mathematical formulas will construct images of the heart based on the detected gamma rays.

How is Cardiac Nuclear Medicine performed?

For the stress part of the examination, you will exercise by either walking on a treadmill or pedaling a stationary bicycle for a few minutes. While you exercise, the electrical activity of your heart will be monitored by electrocardiography (ECG), and your blood pressure will be measured frequently. Before you stop exercising, you will be given the radiopharmaceutical through an IV leading into a vein in your arm. The compound is given when the blood flow to the heart is at its peak because of your exercising. This provides the best opportunity to identify regions of the heart that are not receiving adequate blood flow.

One minute later, you will stop exercising. Approximately one half-hour later, as you lay on an examining table, the compound will have collected in your heart. The gamma camera will then be used to obtain images. The gamma camera likely will move slowly and automatically in an arc over the front of your chest after it is positioned initially by the technologist.

The images obtained after exercise must usually be compared with images of your heart obtained after injection of the same radiopharmaceutical while you are resting. This may be performed before or after the exercise part of the examination, depending on the protocol used. Comparison of the exercise and resting images is done to determine whether coronary blood flow has changed once you have rested and to check for coronary artery disease.

If you are unable to use a treadmill or bicycle, you will not exercise, but you will be given a drug that will cause your heart to work as hard as if you had exercised. You will then be given the radiopharmaceutical.

Immediately after the procedure, a diagnostic radiologist with specialized training in nuclear medicine will check the quality of the images to ensure that an optimal diagnostic study has been performed

What will I experience during my Cardiac Nuclear Medicine procedure?

You may experience some minor discomfort from the intravenous injection of the radiopharmaceutical.

You will be asked to exercise until you are either too tired to continue or short of breath, or if you experience chest pain, leg pain, or other discomfort that causes you to want to stop.

If you are given a medication to increase blood flow because you are unable to exercise, the medication may induce a brief period of feeling anxious, dizzy, nauseous, shaky or short of breath. In rare instances, if the side effects of the medication are severe or make you too uncomfortable, other drugs can be given to stop the effects.

Most patients can resume regular activities immediately after the procedure. The radioactivity in your body will decrease due to the natural process of radioactive decay. In addition, radioactivity will decrease because the radiopharmaceutical passes out of the body in the urine or stool.

What are the benefits vs. risks of Cardiac Nuclear Medicine?

Benefits

- The functional information regarding blood flow to the heart and the pumping function of the heart is well demonstrated. This information may be used to determine what treatment or additional testing, if any, is needed.
- Computers are involved in the generation of the images, so measurements or quantification of function, as well as the determination of abnormalities, are possible.
- Because the procedure is generally performed according to standardized protocols, the type of examination done at one hospital is likely to be similar to that performed at other hospitals, making the information easy to understand or to transfer to all doctors who may be involved in your care.

Risks

- If you have coronary artery disease, it is possible that you could experience chest pain, or angina, when stress due to exercise or a drug is applied to your heart. However, your test will be carried out under the supervision of a specialist trained to monitor you and your heart by using information being provided by the electrocardiogram, by your heart rhythm, and by your blood pressure. If necessary, medication can be given for your chest pain. You will be monitored long enough to ensure that you are at your baseline; that is, the condition you were in when you came for the test.
- The use of a radioactive substance will result in exposure to a small amount of radiation to the heart and to the body. However, the amount of radioactivity administered is the smallest amount necessary to provide adequate images. Cardiac nuclear medicine procedures have been done for more than three decades, and no long-term adverse effects have been reported from such low-dose studies.
- Allergic reactions to radiopharmaceuticals can occur but are extremely rare.
- As with all radiologic procedures, it is important that you inform your physician and the technologist if you are pregnant. In general, exposure to radiation during pregnancy should be kept to a minimum. Depending on the nature of your medical problem, the cardiac nuclear medicine procedure may be postponed until after your pregnancy.

What are the limitations of Cardiac Nuclear Medicine?

Compared with most radiology studies, cardiac nuclear medicine procedures are time-consuming. They involve either exercise or the administration of a drug to increase blood flow to the heart, obtaining gamma-camera images (usually two sets of images separated by a few hours), and then computer manipulation of the information. Depending on the exact procedure performed, the myocardial perfusion scan takes between two and five hours. Occasionally, a patient may be asked to return to the nuclear medicine department the next day. An outpatient may be allowed to leave the hospital between the two sets of images. An inpatient will usually return to his or her hospital room between the imaging sessions.