TEST

Nuclear stress test

A nuclear stress test compares blood flow to your heart muscle at rest and during stress.

WHAT IT MEASURES
Heart muscle blood flow at rest and during stress

SAMPLE
None; gamma-camera or PET imaging

FASTING NEEDED?
Sometimes; usually no food for several hours

HOW LONG IT TAKES
Usually two to four hours

RESULTS IN
Usually one to three days; varies by laboratory

USED FOR
Diagnosis, risk assessment, and monitoring

MAIN LIMITATION
Movement and tissue shadows can create misleading images

Overview

A nuclear stress test is an imaging test that examines blood flow to your heart muscle. It compares images taken while your heart is resting with images taken while your heart is working harder.

A small amount of radioactive material, called a tracer, is injected into a vein. A special camera detects the tracer and shows where blood is reaching the heart muscle.

Your heart may be stressed through exercise on a treadmill or stationary bicycle. If you cannot exercise enough, you may receive medicine that changes blood flow through the heart or makes the heart beat faster.

Most tests use single-photon emission computed tomography, known as SPECT. Some centers use positron emission tomography, or PET. PET can provide additional information about blood flow but is not available everywhere.

This test is also called myocardial perfusion imaging. "Myocardial" means heart muscle, and "perfusion" means blood flow.

Why the test is ordered

A nuclear stress test may help investigate whether narrowed coronary arteries are limiting blood flow to the heart muscle. The coronary arteries are the blood vessels that supply the heart.

It may be ordered to:

It is not usually used as a general screening test for everyone without symptoms. Whether it is appropriate depends on your symptoms, medical history, ability to exercise, previous test results, and overall likelihood of coronary disease.

- Investigate chest discomfort, breathlessness, or reduced exercise ability
- Assess known or suspected coronary artery disease
- Estimate risk after an abnormal heart test
- Check blood flow after a heart attack or heart procedure
- Help plan treatment when coronary disease is already known
- Assess selected people before major surgery

Who should have the test

Your healthcare team may recommend this test when information about heart muscle blood flow could affect your care. It can be useful when a standard exercise electrocardiogram, or ECG, may not provide enough information.

People who cannot exercise safely or reach an adequate workload can often have a medicine-based stress test instead. The choice of medicine depends on conditions such as asthma, severe lung disease, heart rhythm problems, low blood pressure, and the medicines you take.

Tell the imaging team if you may be pregnant or are breastfeeding. Radiation is generally avoided during pregnancy unless the expected benefit justifies it. Breastfeeding instructions depend on the tracer and dose used.

A nuclear stress test is not intended to assess active, unstable symptoms at home. Call emergency services for new or severe chest pressure, severe difficulty breathing, fainting, or symptoms of a stroke.

How to prepare

Follow the instructions from your testing center because preparation differs by protocol.

You will usually be asked not to eat for several hours before the appointment. Small amounts of water may be allowed. If you have diabetes, ask for specific instructions about fasting and diabetes medicines.

Avoid caffeine for the period stated by the center, often at least 12 hours and sometimes 24 hours. Caffeine can block the effect of commonly used stress medicines. Coffee, tea, cola, energy drinks, chocolate, decaffeinated coffee, and some pain or cold medicines may contain caffeine.

Bring an up-to-date list of your medicines and supplements. Beta blockers like metoprolol or propranolol , nitrates, calcium channel blockers like amlodipine or diltiazem , theophylline, dipyridamole, and caffeine-containing medicines can affect the test. Do not stop prescription medicine unless the testing center or prescribing clinician has instructed you to do so.

Wear comfortable clothing and walking shoes if exercise is planned. Avoid heavy exercise before the appointment unless you have been told otherwise.

Tell the team about asthma or other lung disease, recent illness, allergies, pregnancy, breastfeeding, and any difficulty lying flat or raising your arms.

What happens during the test

Small adhesive patches are placed on your chest for an ECG. A blood pressure cuff is fitted, and an intravenous line, or IV, is placed in your arm.

The tracer is injected for the resting images. You may need to wait while it circulates. You then lie on an imaging table while a camera moves around your chest or a PET scanner records images. You need to remain still.

For the stress part, you either exercise or receive medicine through the IV. Exercise becomes gradually harder. If medicine is used, you may feel flushed, breathless, light-headed, or aware of your heartbeat. These effects usually pass quickly.

Your ECG, heart rate, blood pressure, and symptoms are monitored throughout stress. A second tracer dose is given near peak stress, followed by another set of images.

The appointment often takes two to four hours. Some SPECT protocols are split across two days. PET testing may be shorter.

Understanding your results

A specialist compares tracer uptake in the resting and stress images.

A normal result means blood flow appeared similar at rest and during stress. This lowers the likelihood of a major flow-limiting coronary narrowing, but it does not rule out every type of heart disease.

A "reversible defect" is an area that receives less tracer during stress but appears more normal at rest. This pattern can suggest reduced blood flow during exertion, sometimes called ischemia.

A "fixed defect" appears on both sets of images. It may represent scarred heart muscle from a previous heart attack, but tissue shadows or technical factors can sometimes produce a similar appearance.

The report may also describe heart movement, heart chamber size, and ejection fraction-the percentage of blood pumped from the main pumping chamber with each beat.

There is no single universal normal value for every part of this test. Interpretation varies with the laboratory or imaging center, equipment, age, sex, pregnancy status, medicines, previous procedures, and clinical context.

What affects the results

Several factors can make images misleading even when the equipment is working correctly.

Caffeine can prevent vasodilator stress medicines from producing the intended increase in blood flow. This may make an abnormal result look normal.

Beta blockers and some other heart medicines can limit heart rate during exercise. This may prevent you from reaching adequate stress and reduce the test's ability to find a problem. These medicines may be continued intentionally when the goal is to assess blood flow under usual treatment.

Movement, deep breathing, or difficulty lying still can blur images. Breast tissue, the diaphragm, and body size can absorb or scatter signals, creating shadows that resemble reduced blood flow.

A recent meal may increase tracer activity near the heart and make images harder to read. An IV injection that leaks into nearby tissue can reduce the amount of tracer reaching the bloodstream.

Irregular heart rhythms can affect images that are timed to the heartbeat. Limited exercise because of joint, lung, or neurological problems may also make an exercise test less

informative.

Kidney function usually does not directly distort myocardial perfusion images, and the tracer is not the same as iodine-based CT contrast. Pregnancy and breastfeeding mainly affect whether and how the test is performed rather than creating a typical false result. Recent blood transfusion is not generally an important source of error for this test.

Accuracy and limitations

A nuclear stress test can find many important reductions in heart muscle blood flow, but it is not perfect. Its accuracy differs between SPECT and PET, exercise and medicine-based protocols, equipment, image quality, and the population being tested.

The test can miss small areas of reduced blood flow. It can also miss widespread disease when blood flow is reduced fairly evenly in all areas, because the images often compare one part of the heart with another. PET measurement of absolute blood flow may help in some of these situations.

The test may suggest reduced blood flow when no major artery narrowing is present. Movement and shadows from breast tissue, the diaphragm, or body size are common reasons. Disease of the heart's smallest vessels can also cause abnormal blood flow without a large-vessel blockage.

A coronary CT angiogram may be better when a detailed view of artery anatomy is needed. A stress echocardiogram avoids radiation and may be suitable for some people. Invasive coronary angiography may be required when concern remains high or a procedure to treat a narrowing may be needed.

Risks and complications

The IV can cause brief discomfort, bruising, or light-headedness. Infection at the IV site is uncommon.

Exercise or stress medicine can cause chest discomfort, breathlessness, headache, flushing, dizziness, or changes in blood pressure or heart rhythm. Serious complications, including a heart attack or a dangerous rhythm, are uncommon. Monitoring and emergency equipment are available during the test.

The tracer exposes you to ionizing radiation. The amount depends on the tracer, imaging method, and protocol. The material loses radioactivity and leaves the body over time.

Seek emergency help after leaving the center if you develop severe or persistent chest pain, severe breathing difficulty, fainting, or stroke-like symptoms. Mild bruising at the IV site or short-lived tiredness can usually be discussed during routine follow-up.

What happens next

A nuclear medicine physician or cardiologist reviews the images and sends a report to the clinician who ordered the test. Results are often available within a few days.

A normal result may lead to routine follow-up or investigation of another explanation for your symptoms. An abnormal or unclear result may lead to a medicine review, another imaging test, coronary CT angiography, or invasive coronary angiography.

The next step depends on the size and severity of any blood-flow change, your symptoms, heart function, previous procedures, and overall health. An abnormal scan does not automatically mean you need a procedure.

Common questions

Can I drink coffee before a nuclear stress test?

Usually not. Caffeinated and decaffeinated coffee may interfere with medicine-based stress. Follow your center's instructions about how long to avoid coffee, tea, cola, chocolate, energy drinks, and caffeine-containing medicines.

Can I drink water before the test?

Small amounts of plain water are often allowed, including for essential medicines. Confirm this with the testing center because fasting instructions differ.

Does the time of day matter?

The medical accuracy does not usually depend on morning versus afternoon. Appointment time affects when you must stop eating and consuming caffeine, especially if you have diabetes.

Can I exercise beforehand?

Avoid strenuous exercise on the day of the test unless instructed otherwise. Arrive rested, particularly if treadmill or bicycle exercise is planned.

Can I drive home afterward?

Most people can drive after an uncomplicated test. Arrange help if you were given a sedating

medicine, feel unwell, or the center advises against driving.

Will I be radioactive afterward?

A small amount of tracer remains temporarily. Normal contact with other adults is usually allowed, but the center may give short-term precautions around pregnant people or young children.

Sources

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