

Cardiology at Concorde

Specializing in Non-Invasive Cardiology



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Stress Testing Explained

One of the most common heart tests performed in the United States today is the treadmill stress test. We use this test to determine if one or more coronary arteries have cholesterol narrowing that can cause decreased blood flow to the heart muscle and produce symptoms such as shortness of breath or chest pain.

The treadmill test is calibrated to the age of the patient. Someone in their 40's might be expected to complete 15 minutes of treadmill time compared with someone in their 60's who might be stressed for 9 or 10 minutes.

In those instances in which patients are too frail or unable to exercise on the treadmill, drug or "pharmacologic" stress testing is done, often in combination with the nuclear stress test. The patient lies on the exam table in a comfortable position. A medication that stresses the heart for a period of about 6 minutes is given through an IV. As in the treadmill stress test, the isotope is given at the "peak" of the medication stress effect. A minute later, the drug stress is stopped or reversed with an antidote that eliminates the drug effect on the heart. The drugs used in these tests are known as dipyrimadole, adenosine and dobutamine. Each medication has specific side effects, which are carefully watched for during the test

The point of any stress test is to increase the work of the heart along with the heart rate and blood pressure. When the heart is stressed, symptoms such as chest pain or shortness of breath may appear. As long as the patient feels well, the treadmill speed and elevation is increased every 3 minutes. During this time, the performing cardiologist observes the heart rate, takes

the blood pressure, views the minute-to-minute EKG on the monitor and talks to the patient about their reactions. Although reaching the target heart rate is the goal of the test, if the patient develops worrisome symptoms or changes on the EKG, the test may be stopped prematurely. When the patient reaches the target heart rate, the second part of the analysis is done. The target heart rate is 85% of the predicted maximum heart rate (85% X (220 minus your age)). Reaching the target heart rate makes the test more accurate than if lower heart rates are achieved. Patients who are taking beta-blockers are asked to stop this medication 24 hours before the test because these drugs slow the heart rate and make the test less accurate.

It is the second part of the test that involves a variety of approaches to making the diagnosis. If this is an “EKG only” test, the physician will review multiple EKG’s taken before, during and after the test to look for changes that can reflect a lack of blood flow to the heart muscle. These changes can be subtle and sometimes ambiguous. The accuracy of this test is about 65-75% in men and less so in women. The reasons for the lower

“In women, the stress echocardiogram offers accuracy in the 85% range and reduces the frequency of false positive results.”

accuracy of the test in women is still unknown but is due in some part to minor changes in the resting or baseline EKG of some women which can produce abnormal results even in women with normal arteries.

It was largely because of this lower accuracy of the “EKG only” test that other forms of stress tests have been devised. In this test, the patient has a resting sonogram of the

heart. Computer images of the heart muscle contracting at rest are displayed on the left side of the screen in a continuously looping format. Within a minute of completing the treadmill test described above, the patient is asked to lie on the exam table for a second set of images. These stress images are displayed on the right side of the screen. The rest and stress images are displayed side by side and a portion-by-portion analysis of the heart wall motion is made. In normal patients, every part of the heart wall increases its motion in response to exercise. In some patients with coronary narrowing, the slower blood flow to that part of the heart wall makes the motion decrease. It is important to note that the lack of blood flow is inferred and not actually visualized in the echo stress test. Since other heart conditions can produce changes in wall motion, there is still about a 15% error rate in this kind of stress test. This means that if the test is positive or negative, there is still a 15% chance that either diagnosis is incorrect.

The most sophisticated stress test in current practice is the nuclear stress test. In this test, the familiar treadmill protocol is followed exactly as noted above. When the patient reaches the target heart rate, a dose of radioactive isotope is injected, travels through the circulation and is taken up into the heart muscle. The special isotopes we use act like the patient's own flowing blood and only go to the areas of the heart where the blood is flowing normally, with less going to the areas where the arteries are blocked. At the peak of exercise, the injected material takes a "snapshot" of the heart circulation at that moment in time. These pictures are then compared side by side with the ones taken when the patient first came to the office an hour earlier for resting images. Comparing these images will determine if there is a subtle lack of blood flow during exercise that would imply a narrowed artery. Although this test is somewhat more sensitive and accurate in determining the presence of blockage compared to the stress echo, false positives still occur. This can present a dilemma to cardiologists and their patients, especially in cases where the symptoms and EKG findings are ambiguous.

"When a nuclear stress test is ambiguous, further evaluation is often needed. At this point, the cardiologist may feel that direct visualization of the arteries is needed."

Injecting "dye" or iodine-containing fluid that will show up on fluoroscopy (coronary angiogram) is the gold standard for deciding if coronary narrowing is the cause of a patient's symptoms. For more details about this procedure, see the items in our Patient Learning Center under CT angiography and cardiac catheterization.