

Investigations of Coronary Artery Disease

Electrocardiogram

Electrocardiogram (ECG or EKG) is one of the most common tests for coronary heart disease. It is simple and often very valuable. However, this must be viewed in the light of the history, physical findings, and results of other investigations, together with its limitations. The resting ECG could be entirely normal in the presence of severe coronary artery disease. Even if it demonstrates the presence of ischaemia, ECG cannot confirm the exact anatomical distribution or the severity of damage in the coronary artery involved.

Exercise Stress Test (Treadmill)

Exercise stress test is used to record continuously the ECG during a fixed set of exercises, usually walking on a motorized treadmill. The exercise lasts 6 to 12 minutes depending on the fitness of the person. When a person with heart problem exercises, the workload of the heart is increased, thus requiring additional supply of oxygen that may not be available. This activity could result in chest pain or an irregular heartbeat. The test should be terminated if the patient experiences severe chest pain, serious irregular heart rhythms, or abnormal change in blood pressure.

Patients with severe anginal attacks, dangerous irregular heart rhythm, heart failure, uncontrolled high blood pressure, should not take the exercise stress test.

Echocardiogram

An echocardiogram is a procedure that uses sound waves (ultrasound) to evaluate the structure and function of the heart. When a transducer, a wand-like apparatus, makes high frequency sound that cannot be heard by human, is positioned on the chest wall, a graphic image of the heart's structure is immediately produced.

The examination enables assessment of the contraction of the heart, conditions of heart valves, detection of the presence of narrowing or leakage of the valves, as well as fluid accumulated in the pericardial cavity. It can also measure the pressures of pulmonary vessels that may indicate presence of heart and lung diseases.

Ultrasound is painless, convenient, and harmless. However it does have limitations. Not every part of the heart or the coronary arteries can be visualized.

Very obese patients and patients with emphysema cannot be assessed by this method.

Ambulatory ECG Monitoring (Holter)

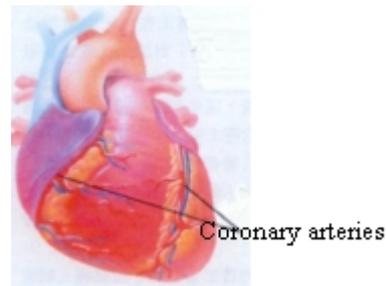


Echocardiogram

Holter monitoring is used to detect abnormal electrical conduction in the heart and abnormal cardiac rhythm. It can also record ischaemic changes even if the patient is asymptomatic.

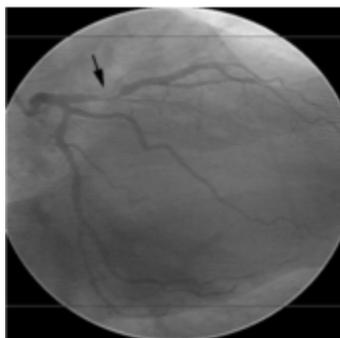
ECG electrodes are placed on the chest wall with wires connected to a small recorder to be worn for a certain period, usually 24 – 48 hours. All daily activities (except showering or swimming) can be continued during the period of recording. The patient is given a diary to record the nature and time of occurrence of symptoms such as chest pain or dizziness. All data recorded is subsequently retrieved and analyzed on computer.

Coronary angiography is performed to accurately define the presence and severity of coronary artery disease



There are 3 main coronary arteries supplying the heart muscle. The left coronary artery and the right coronary artery arise from the left and right side of the aorta respectively. The left main artery is short and divides into the left anterior descending and left circumflex arteries.

During the examination, a sheath is inserted through a small puncture site of the artery in the groin called the femoral artery. With the support of a guidewire, a catheter is carefully directed through the aorta into the left and right coronary arteries under fluoroscopy. Once the catheter is in place, contrast medium is injected. Images are taken from different angles to accurately show any narrowing from atherosclerosis. A stenosis is present when there is discrete reduction in luminal diameter.



Left coronary arteriogram showing a narrowed area



Left ventriculogram

Left ventriculography is usually done in the same setting. A catheter is passed across the aortic valve and introduced into the left ventricle. 30-40cc of radiographic contrast material will be injected through the catheter to assess the function and ejection fraction of the LV. The study also enables determination of

the ventricular dimension and function of the mitral valve.

At present, coronary arteriogram provides the best anatomical definition of luminal narrowing of coronary vessels. It however gives little information on the wall of the vessel. It is invasive and carries a small and definite amount of risk.

Cardiac Magnetic Resonance (Cardiac MR)

Magnetic resonance imaging uses magnetic and radiofrequency fields to generate high-resolution images of the heart and blood vessels. It is non-invasive and does not entail any ionizing radiation. Should any intravenous contrast be given, allergy seldom occurs.



The cardiac structure, function, perfusion, viability, coronary arteries and peripheral vessels can be studied in finite details.

Cardiac MR enables:

Accurate assessment of dimensions, volumes, contraction of the ventricles, ejection fraction and cardiac output.

Perfusion and viability of heart muscle.

Visualization of proximal coronary arteries and peripheral vessels

Accurate assessment of the severity of congenital heart disease.

Detection of abnormality such as presence of thrombus, tumors, etc.

Cardiac magnetic resonance has become the corner-stone of cardiac imaging in this millennium. It is also the investigation of choice for aortic dissection and aortic disease.

Thallium Scan

Thallium is a radioactive substance. When injected into a vein, it will be taken up by heart muscle. When blood flow to the heart is reduced because of narrowed coronary arteries, less thallium will reach the heart muscle.

Thallium scan is used to detect significant coronary artery narrowing as well as heart muscle damage as a result of heart attack.

A special camera is positioned above the chest of the patient lying on the scanning table. Two sets of pictures will be taken. One set is taken at rest. The other set is taken after walking on the treadmill or after some medication is given to stress the heart.

Each set of pictures takes about 20 minutes. There is an interval between the two sets of pictures. The whole test will take about 3 hours.