

# Testing for Heart Disease

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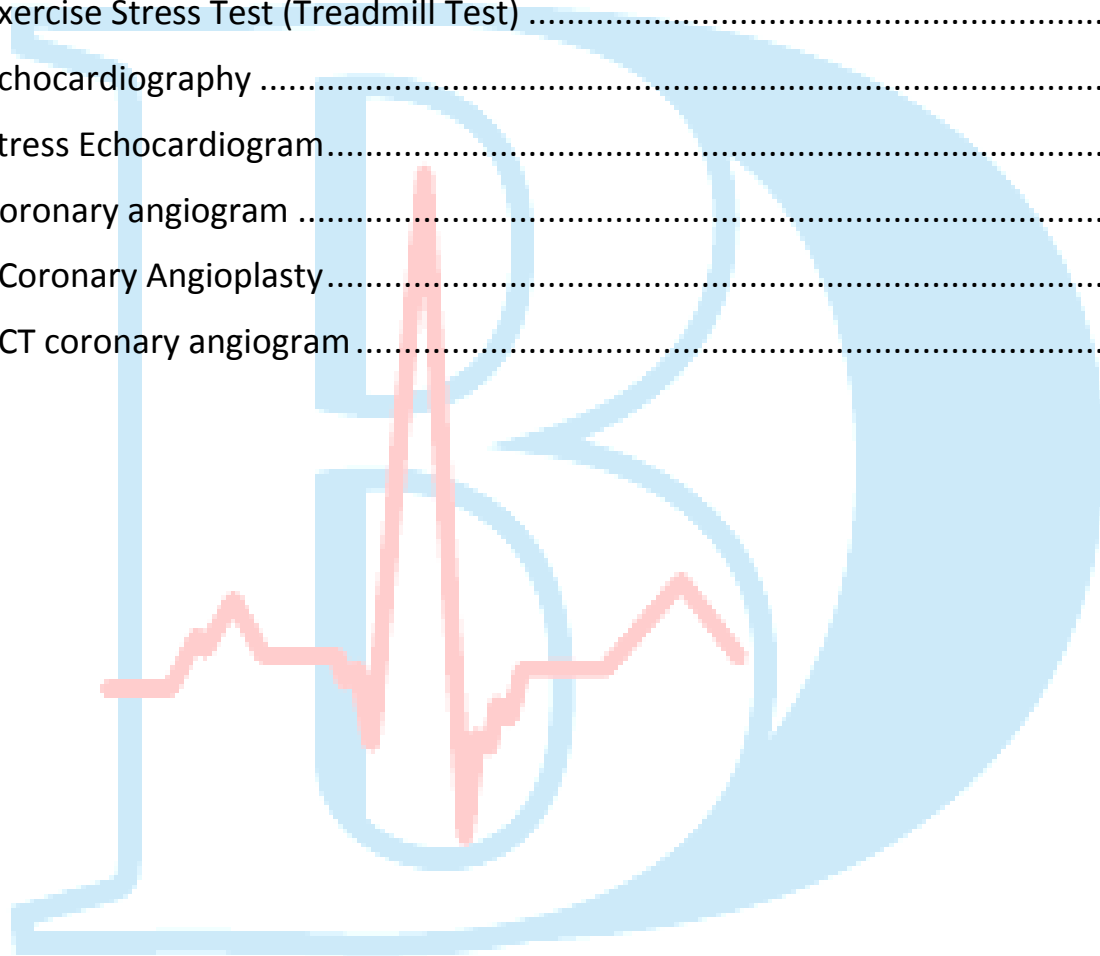
Part of the patient information booklet series by



**Baliga Diagnostics**  
Pvt. Ltd.

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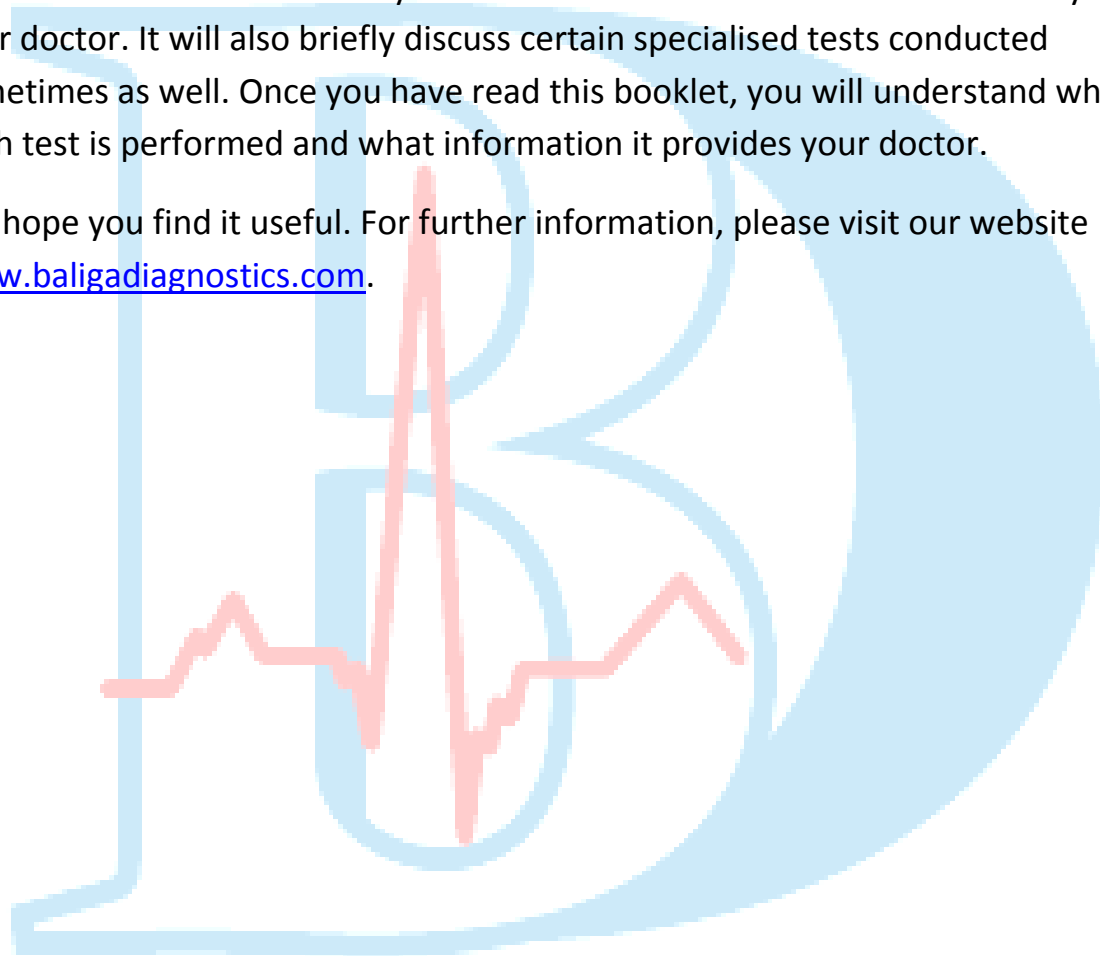
# 1. Introduction

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When you go to see your doctor with heart problems, you will undergo a number of tests that will aid your doctor in diagnosing the problem and guide him/her to prescribe the right treatment. There are a variety of tests that can be performed, with each one of them providing different pieces of information.

This booklet will discuss briefly the common tests that will be conducted by your doctor. It will also briefly discuss certain specialised tests conducted sometimes as well. Once you have read this booklet, you will understand why each test is performed and what information it provides your doctor.

We hope you find it useful. For further information, please visit our website [www.baligadiagnostics.com](http://www.baligadiagnostics.com).



## 2. Blood tests

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The most commonly performed test in patients with any problems with their health are blood tests, and this is true even in the case of heart diseases. You may be asked to come to the pathology lab having observed an overnight fast (i.e. no food or water intake from midnight till the test) as this will provide valuable information.

The most commonly performed blood tests are:

- Complete blood count
- Kidney function
- Liver function
- Fasting blood cholesterol
- Fasting blood sugar
- Thyroid function tests
- Special blood tests

Your doctor will only request the tests that will help in diagnosis.

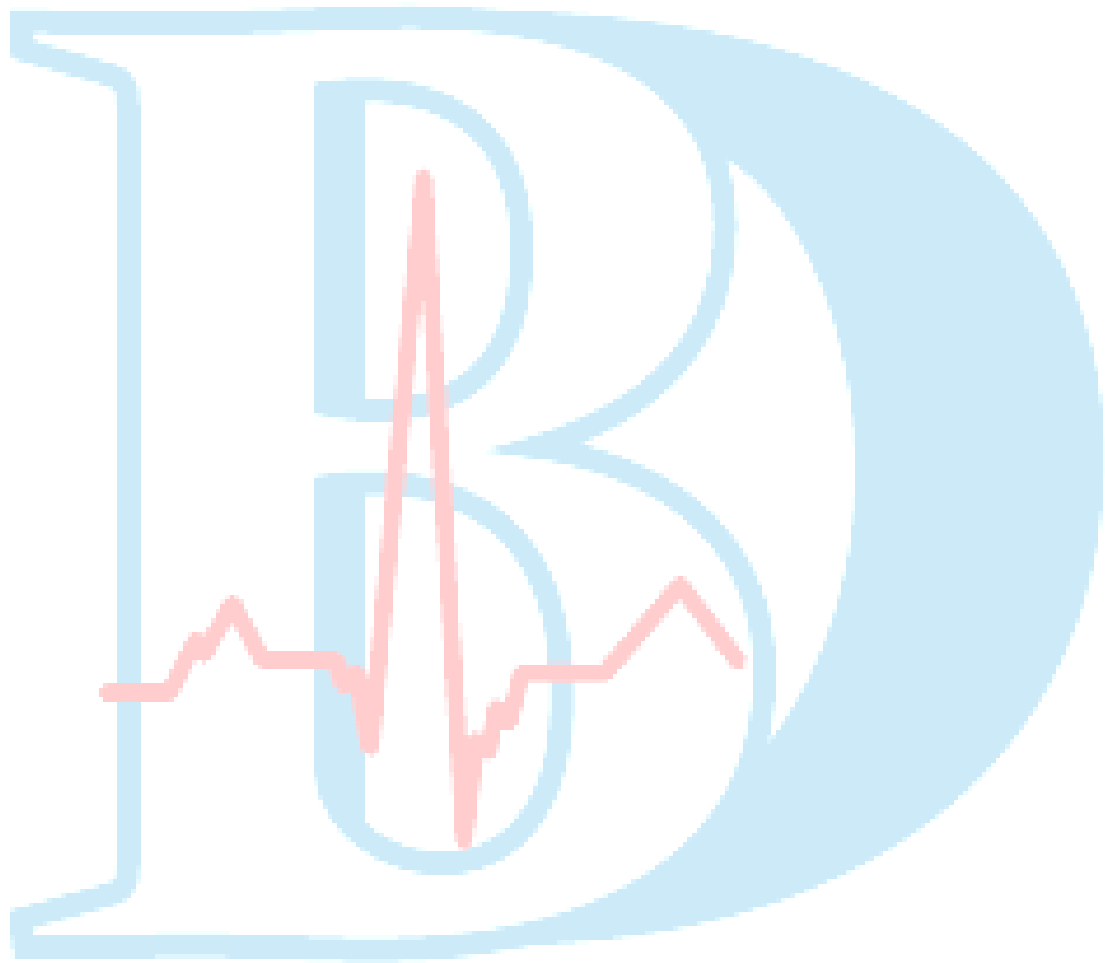
1. **Complete blood count (CBC)** – This test assesses the haemoglobin content of the blood and the white cell count. Haemoglobin is what makes the blood red, and carries oxygen. When this is low, it is called 'anaemia'. Anaemia is a common cause of heart disease, and can be due to a number of factors such as poor diet, blood loss and hookworm infestation. It is easily treated with tablets, though sometimes a blood transfusion may be required. The white cells are cells in the blood that fight infection. There is no strong relation between white cell counts and heart disease, though a high white cell count may occur if there is infection or inflammation ongoing in the body or the heart.
2. **Kidney function tests** – This helps assess whether or not the kidneys are functioning normally. It assesses the sodium, potassium, urea and creatinine levels in the blood. When the kidney function is abnormal, it could be due to a number of causes, including poor blood supply to the kidney, dehydration, drugs and other treatment, or problems with the kidney itself. Kidney function tests are also useful to monitor treatment

prescribed for heart problems, as many of these drugs are broken down in the kidneys and can be toxic to them.

3. **Liver function tests** – This assesses the function of the liver in getting rid of toxins and metabolising drugs. The liver is a vital organ that gets rid of a number of toxins in the blood. Its function can be affected by high intake of alcohol, certain drugs, viral inflammation (hepatitis) and sometimes by problems within the liver itself. By knowing what the liver function is, your doctor will be able to prescribe treatment that is good for the heart and does not affect the liver.
4. **Fasting blood cholesterol** – This provides the doctor with valuable information regarding how much fat there is in the blood. A high blood cholesterol is associated with thickening of the arteries (called atherosclerosis) and the development of heart attacks and strokes (for further information, please refer to our booklet 'High Cholesterol, Lipids and Heart Disease'). Ideally this test is best done first thing in the morning on an empty stomach so as to get the true value. When elevated, your doctor will either give you dietary advice, prescribe drugs or both.
5. **Fasting blood sugar** – This test is done to see if the patient has diabetes. Diabetes mellitus is a condition where the production of insulin in the body is low, and thus the blood sugar level is high (for further information, please refer to our booklet 'Diabetes and Heart Disease'). A number of research studies have shown a strong relationship between diabetes and heart disease. If this is elevated, patients are advised either dietary control, tablets, insulin injections or all of these.  
In some patients, a test called the post-prandial blood sugar test may be performed. This test helps evaluate the body's response to ingestion of food and the release of insulin. A high post-prandial blood sugar above the normal range points towards a diagnosis of diabetes mellitus.
6. **Thyroid function tests** – This test assesses the function of the thyroid gland, which is a small gland in front of the throat. It secretes hormones that perform a number of functions. By testing this, it is possible to assess whether the gland is functioning normally or whether it is over-active or under-active. An overactive or under-active thyroid gland can cause heart problems such as palpitations and breathlessness.

7. **Special blood tests** – On occasions, the doctor may ask for special tests to assess other factors that can play a role in heart disease or even help diagnose heart disease. The list is long and has not been discussed here, but will be discussed with you by your doctor if required. Some of the tests include vitamin D and vitamin B12 levels and blood iron levels.

A full list of blood tests that we offer is listed on our website at [www.baligadiagnostics.com](http://www.baligadiagnostics.com).



## 2. Electrocardiogram (ECG)

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An electrocardiogram (ECG) is a simple and valuable test used to study the electrical activity of the heart. The heart possesses a tiny electrical generator that fires small bursts of electricity throughout the heart muscle and results in it contracting and relaxing. These little bursts of electricity can be detected with an ECG.

ECGs are performed routinely in people who are unwell, but are particularly important in people suffering from heart problems. The test provides valuable information in patients suffering from palpitations and chest pain. The test is completely painless.

### **How is an ECG performed?**

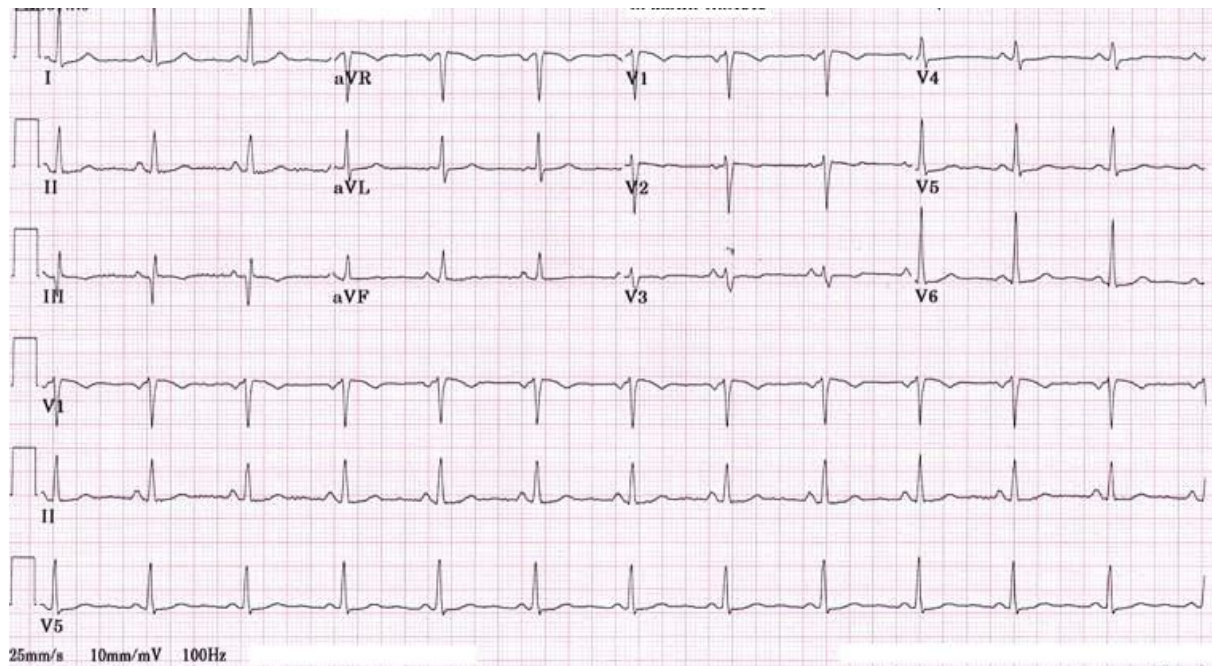


The ECG machine consists of a central analysis and printing unit, to which are attached a number of wires (called leads). These are attached to specific parts of the chest to aid recording of electrical activity in different parts of the heart muscle. The patient will be asked to undress to the waist and then to lie on the examination couch. The leads are attached to the chest. These leads then transmit the electrical impulses to the central machine, which then amplifies them and records them onto paper or onto a computer. The test takes no more than 5 -10 minutes to perform.

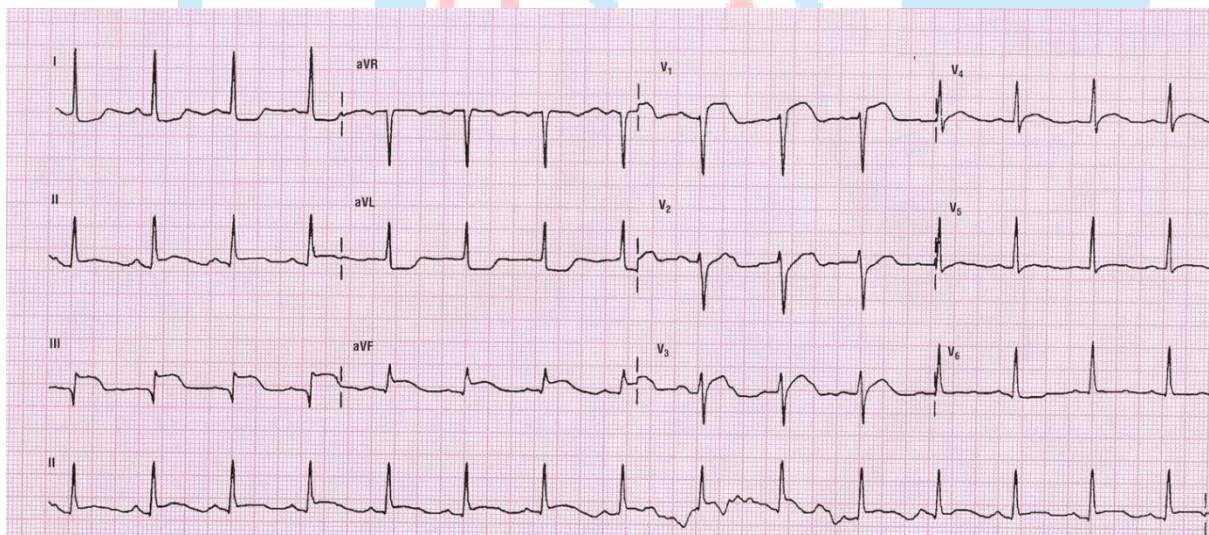


## What information does an ECG provide?

The ECG records information from different parts of the heart. A normal ECG is shown in the figure 1 below.



**Figure 1: Normal Electrocardiogram**



**Figure 2: An ECG in a heart attack – the difference is clearly seen when compared to figure 1.**



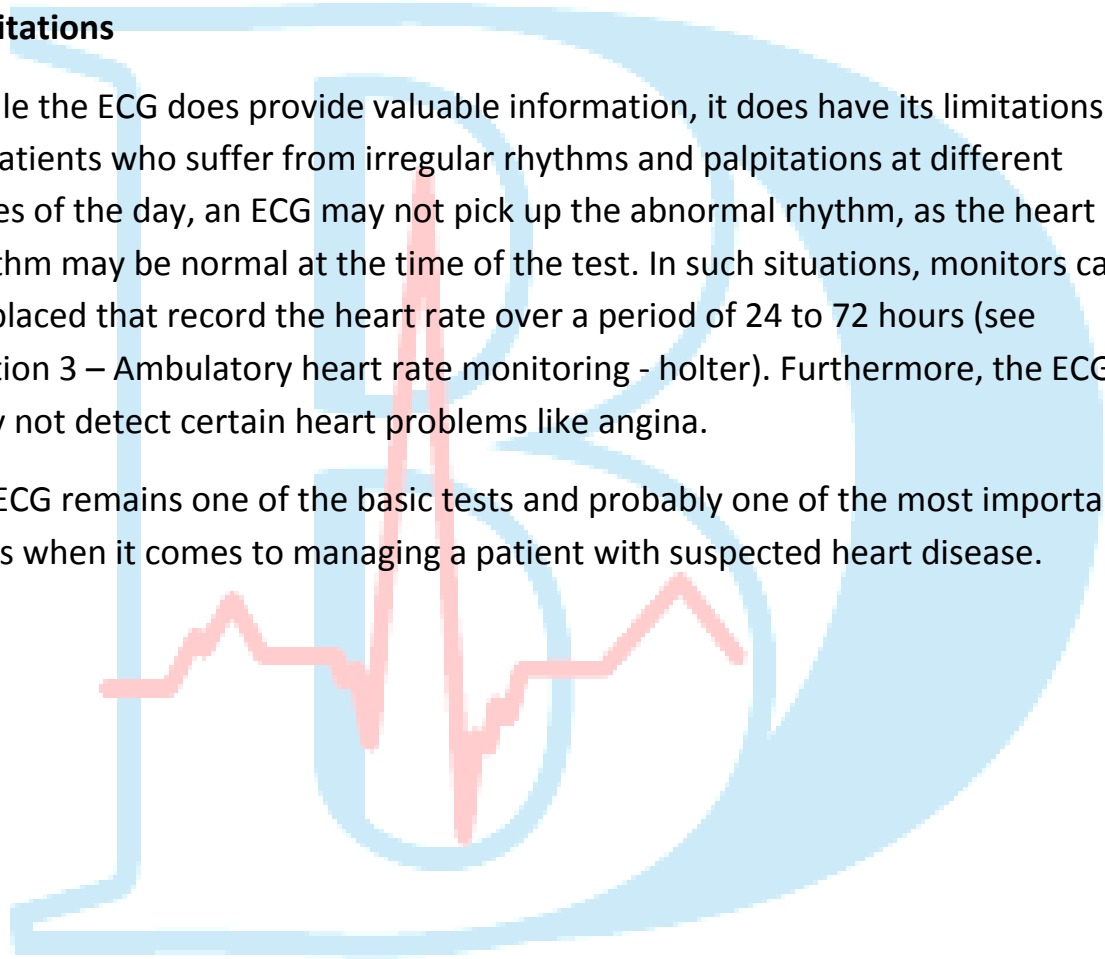
An ECG is useful in detecting the following:

- Normal function – Is the heart beating at a normal rate and rhythm?
- Heart attacks – An ECG can detect if a patient is having a heart attack, or had one in the past (see figure 2).
- Arrhythmias – An arrhythmia is an irregular heart rhythm. ECGs can detect how fast the heart is beating, and which part is beating irregularly (see limitations below).
- An enlarged heart – The tracing appears bigger than normal.

### Limitations

While the ECG does provide valuable information, it does have its limitations. In patients who suffer from irregular rhythms and palpitations at different times of the day, an ECG may not pick up the abnormal rhythm, as the heart rhythm may be normal at the time of the test. In such situations, monitors can be placed that record the heart rate over a period of 24 to 72 hours (see section 3 – Ambulatory heart rate monitoring - holter). Furthermore, the ECGs may not detect certain heart problems like angina.

An ECG remains one of the basic tests and probably one of the most important tests when it comes to managing a patient with suspected heart disease.



### 3. Chest X-ray

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A chest x-ray is a procedure where an image of the chest is taken using an x-ray machine. It offers some basic information regarding the state of the heart and the lungs and is a commonly performed test in all patients who suffer from chest pain and breathlessness.

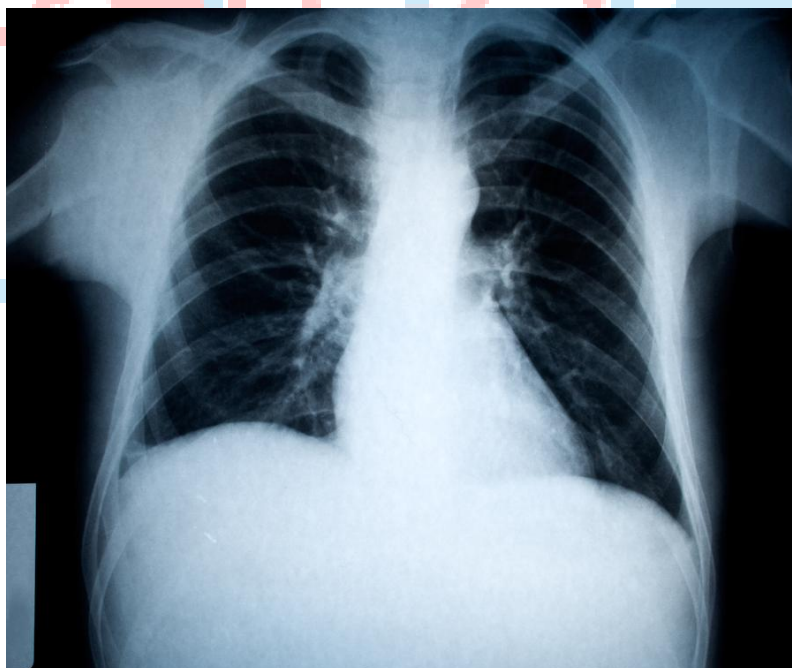
#### **How is it performed?**

The procedure is fairly straightforward and involves a patient sitting in front of an x-ray machine. Once the patient is in position, the x-ray machine is placed near the chest and an image is taken. This image projects onto an x-ray film which is then offered to the patient.

The procedure takes only a few minutes to perform.

#### **What information does it provide?**

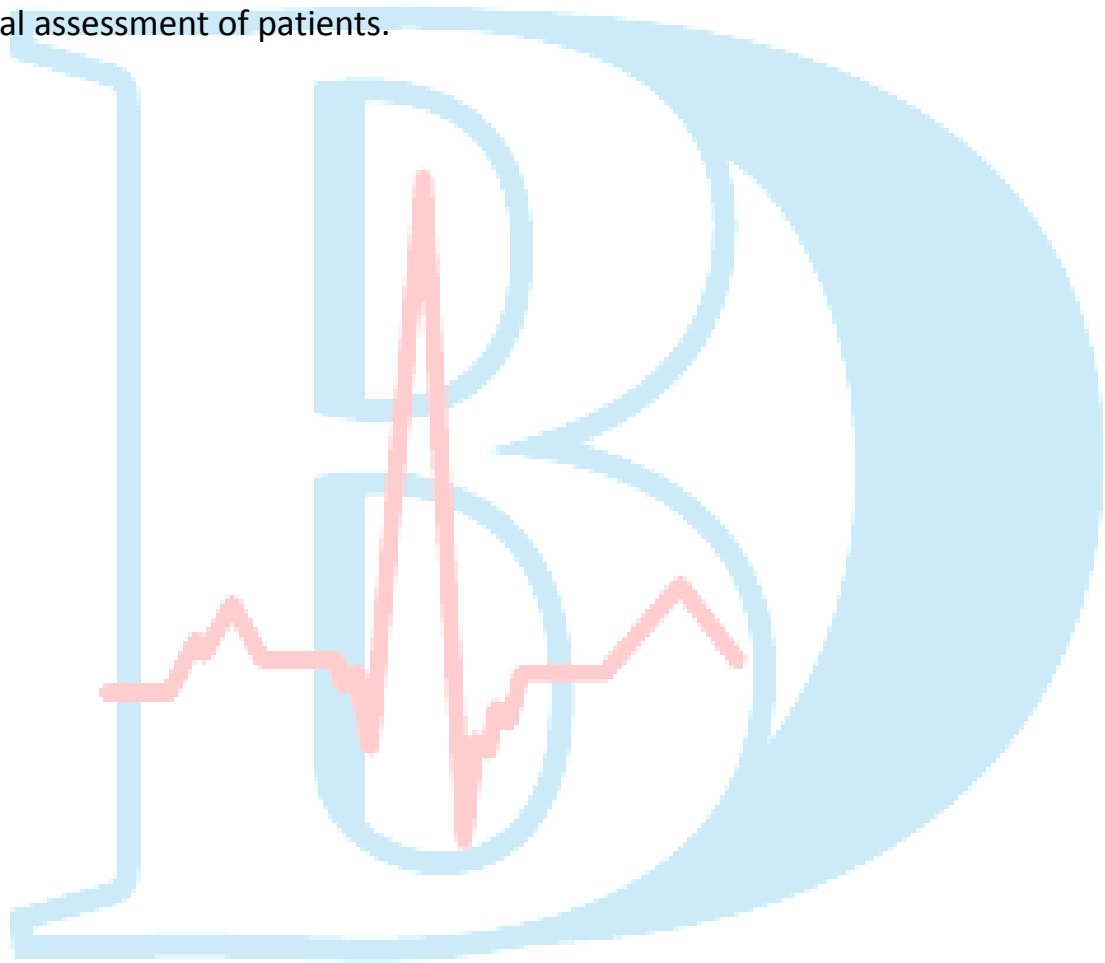
A chest x-ray helps visualise the ribs, lung fields, diaphragms and the heart. It provides information regarding the size of the heart, whether there is any fluid in the lungs and whether there are any fractures or other causes for the patient symptoms. In addition, any chest infections and pneumonias are clearly visible on x-ray and can help direct appropriate treatment.



## Limitations

Unfortunately, a chest x-ray only offers certain pieces of information and is not an exhaustive test in any sense. It is an excellent tool for monitoring patient's progress when they are in hospital, particularly if they are suffering from heart failure and have accumulated fluid in the lungs. However, it does not offer any information regarding the function of the heart as such and neither does it inform the doctor regarding the state of the heart valves.

Despite its limitations, the chest x-ray is still a very useful test when it comes to initial assessment of patients.



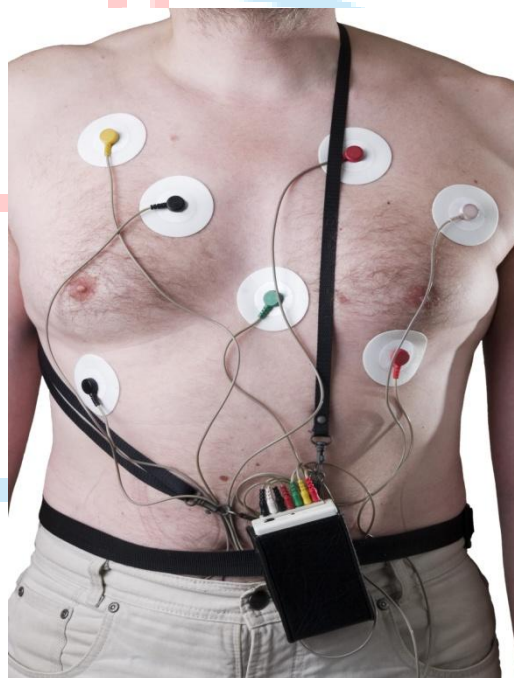
## 4. Ambulatory Heart Rate Monitoring (Holter)

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An ambulatory heart rate monitor records the heart rate over a longer period of time when compared to an ECG, usually between 24 hours and 72 hours. It is useful in recording the heart rhythm in patients who are experiencing symptoms such as palpitations or breathlessness at various times of the day.

### How is it performed?

The test is simple. You will be asked to attend the clinic to have the device fitted. The device is a small recorder that is strapped around the chest or abdomen. To this are attached leads that are attached at different points on the chest. Once switched on, the device records the heart rate over the required time. It takes around 10-15 minutes to fit the device on. **It is advised not to have a shower or bath during the time when wearing the device, as water can ruin the device.** It can be worn when asleep.



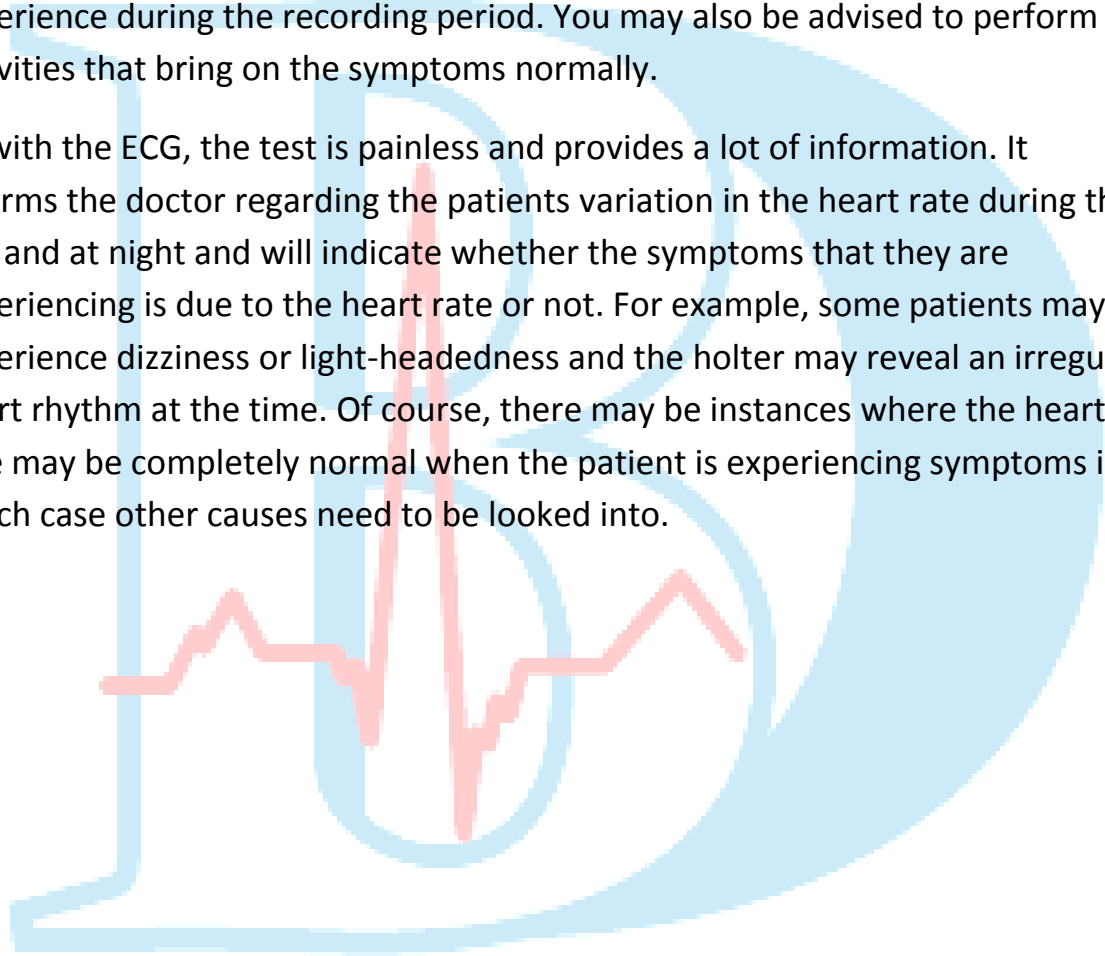
Once the 24-72 hour period has passed, you will be asked to return the device. The data on the device will then be analysed and results viewed by your doctor.

## What information does it provide?

The information it provides is similar to the ECG, but does have a few differences. The recording gives the doctor information regarding the heart rate over an entire day rather than at just one point in time. This means it can provide information if the heart is beating too fast or too slow at different times of the day. It does not always look at different parts of the heart like the ECG does, and may not be useful in diagnosing heart attacks.

You will be provided with a diary to record any symptoms the patient may experience during the recording period. You may also be advised to perform activities that bring on the symptoms normally.

As with the ECG, the test is painless and provides a lot of information. It informs the doctor regarding the patient's variation in the heart rate during the day and at night and will indicate whether the symptoms that they are experiencing is due to the heart rate or not. For example, some patients may experience dizziness or light-headedness and the holter may reveal an irregular heart rhythm at the time. Of course, there may be instances where the heart rate may be completely normal when the patient is experiencing symptoms in which case other causes need to be looked into.



## 5. Ambulatory Blood Pressure Monitoring

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In patients who suffer from high blood pressure, it is essential to diagnose whether the blood pressure readings are truly elevated or whether it could be what is called 'white-coat hypertension' (white-coat hypertension is a rise in blood pressure due to apprehension regarding seeing a doctor). In such patients, an ambulatory blood pressure monitor may be attached to record the blood pressure readings over a period of 24 hours. This provides a more realistic picture regarding the patient's blood pressure while they are at work or in the comfort of their own home.

### **How is it performed?**

The procedure is fairly straightforward and involves the placement of a blood pressure cuff around the upper arm. This blood pressure cuff is then attached to a small device that is hung around the shoulder. This device inflates blood pressure cuff 24 times over 24-hours. Once the device is attached, the patient can wear their regular clothing over it and carry on with their normal daily routines.

No special preparation is required for patients to undergo this test. If patients are taking medication for blood pressure or for any other condition, they are requested to continue doing so and do not stop their treatment.

Once the test is complete, the device is returned to our centre and the information is downloaded. A report is usually available in 24 to 48 hours.

### **What information does the test provide?**

Ambulatory blood pressure monitoring is a good test to assess blood pressure changes throughout the day when at work or at home and also at night when asleep. A constantly elevated blood pressure over and above the normal range which persists even at night is indicative of underlying hypertension.

This test also helps assess patient's response to blood pressure medication. For example, if patients have been commenced on a number of different tablets to control their blood pressure, and their blood pressure remains high when they



come to see a doctor, then performing this test can help assess the true blood pressure readings when the patient is at home.

The ambulatory blood pressure monitor records the upper and lower limits of blood pressure throughout the day and offers an average blood pressure reading as well. The report will also indicate the amount of time during the 24-hour period that the blood pressure remains elevated.

In patients who have normal blood pressure, there is usually no significant alteration during the day or at night. However, in patients who have hypertension, there may be an excessive fall in blood pressure at night or the blood pressure may remain persistently elevated above the normal range. This aids a diagnosis of hypertension.

### **Is the test painful?**

This test is non-invasive and does not involve any needles or sharp objects. The blood pressure cuff will inflate and deflate a number of times during the day and this can feel like a tightening around the arm which last for only a few seconds. Though this may be slightly uncomfortable, it does not cause any significant pain to the patient.

### **Limitations**

While ambulatory blood pressure monitoring is an excellent test, sometimes readings may be fairly variable in patients and may not offer sufficient information to the doctor regarding their true blood pressure. In addition, some patients find that the tightening of the cuff around the arm when BP recordings are being taken can disturb the sleep at night. In patients who have irregularities of their heartbeat, readings may not be totally accurate.

## 6. Exercise Stress Test (Treadmill Test)

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An exercise stress test is a test that is performed to diagnose patients who may be suffering from a suspected heart disease. It is a commonly performed test these days though on some occasions other tests may need to be performed if the results are inconclusive.

### **How is it performed?**

An exercise treadmill test is performed as an outpatient test. It involves a patient having to walk on a treadmill while being attached to an ECG monitor that records the heartbeat throughout the test.

The patient arrives at the diagnostic centre ideally on an empty stomach. It is recommended that the patient wear comfortable walking shoes so that they may not experience any inconvenience or difficulty walking on the treadmill. A full consent will be taken and the patient is then attached to the monitor using a series of ECG leads on the chest wall. Female patients will be offered a gown during the test.

Once the patient is attached to the monitor, there will be asked to lie down and a blood pressure recording will be taken. The patient will then be asked to stand up and another BP recording will be taken. Following this, a technician or the doctor will demonstrate how to walk on the treadmill and once the patient feels comfortable there will be asked to stand on the treadmill. The treadmill is then turned on and the patient is asked to walk at a steady pace keeping their back straight and looking straight ahead. While this may be slightly difficult initially, there is nothing to worry about as the technician or the doctor will offer the guidance and support that is required to make sure that the patient is comfortable.

The treadmill moves at a slow speed to start off with and has a slight incline (depending on the type of test). It feels as if one is walking up a hill. Every 3 min, the doctor will check the patient's blood pressure and record it. At the same time, the treadmill will increase in speed and incline slightly. The heart rate will be constantly monitored as will the blood pressure.

If at any point, the patient develops any chest pain or is unable to walk comfortably on the treadmill, the test will be stopped either at the physician's request or at the patient's request. Following this, another BP recording is retaken and the patient will be asked to relax for a few minutes before the test is concluded.

The entire test can take anywhere between 30 to 45 min to perform. This depends completely on the exercise capacity of the patient and also on the information that is obtained during the test.

After the test has concluded, the ECG leads will be taken off and the patient will be asked to dress themselves. The report is offered immediately after the test. Recommendations for further investigations may be offered as well.

### **What information does the test provide?**

An exercise stress test offers information regarding whether or not the heart is able to undergo increasing amount of stress during exercise. If there is underlying narrowing of the heart arteries which is cutting off the blood supply to the heart muscle significantly, then during the exercise test, there will be changes on the heart monitor that will demonstrate this. Patients may experience chest pain along with these changes and this is fairly diagnostic of underlying coronary artery disease.

In addition, the exercise stress test also provides information regarding the exercise capacity of patients and can sometimes be performed for patients with heart failure. It is also performed for patients who have undergone previous coronary artery bypass grafts or coronary intervention of any sort.

### **Types of exercise stress tests**

While there are a number of different types of exercise stress test protocols, we currently offer two different kinds - Bruce protocol and modified Bruce protocol. The difference between the two is the stress the patient undergoes during the test. The Bruce protocol is often offered to patients who are healthier and can withstand a greater degree of stress on the treadmill while the modified Bruce protocol is offered to patients who have underlying heart disease and who may not be able to tolerate the Bruce protocol.

The decision as to which protocol is best suited for the patient will be made by the physician.

### **Limitations**

The information obtained from an exercise stress test may sometimes be inconclusive as the patient may not be able to tolerate the procedure very well. In addition, there may be certain changes seen on the ECG that are not particularly indicative of underlying coronary artery disease. The test requires that patients walk for a few minutes at least and unfortunately some patients may struggle to do so.

A treadmill test will not be performed in certain patients who suffer from narrowed heart valves, a very recent heart attack and severe heart failure. If the patient's blood pressure is very high at the start of the test, the exercise stress test may not be performed.

### **Risks of the procedure**

An exercise stress test is performed under close supervision by a physician. While the risks of any sort are rare, it is good to be aware that in patients who have significant underlying coronary artery disease that has not yet been diagnosed, and exercise stress test can induce chest pain and sometimes even cause a heart attack. Some patients may also experience an irregular heartbeat. These are risks are extremely rare.

We currently offer exercise treadmill tests (Bruce and modified Bruce) at Baliga Diagnostics Pvt. Ltd.

## 7. Echocardiography

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An echocardiogram is a test that helps visualise the heart with an ultrasound machine. It is a valuable test that helps view the structure and function of the heart muscle, heart valves, and vessels arising from the heart.

### **How is it performed?**

An echocardiogram (sometimes just called 'echo') is performed using an ultrasound machine that has capabilities for taking pictures and videos of the heart. There are a number of buttons on the machine that aids making special measurements. On the machine is a large screen that displays all the images. Attached to the machine is a probe, which possesses small crystals, called 'piezo-electric crystals'. These emit ultrasound waves that is converted to digital information and displayed on the screen.

The patient will be asked to attend the department in for the test. There is no need to fast and no special preparation is required, unless the doctor requests so.



Prior to the test, the patient will be asked to undress to the waist and lie down on an examination couch. ECG leads are attached to the chest so that the heart can be monitored during the test. The patient will be asked to lay on his/her

left side, with the left arm tucked behind the head. The ultrasound probe is then placed on the chest and images are obtained.

The test takes between 30-40 minutes to perform, and is painless.

### **What information does the test provide?**

An echocardiogram provides plenty of information in numerous heart conditions that aid diagnosis and guide treatment. Some of the information it can provide is:

- Heart muscle structure and function – Thickness of the muscle, any scarring, any thinning of the muscle, pumping action of the muscle.
- Valve structure and function – valve opening and closing, any infection, any leak or narrowing.
- Pericardium structure – the pericardium is a thin lining that surrounds the heart (like a protective casing). An echo can view structure and any fluid around the heart.
- Vessel structure – assess structure of aorta, pulmonary artery and inferior vena cava.

### **Is the test painful?**

Sometimes, when assessing the heart with an echocardiogram, the probe may need to be pressed firmly onto the chest. This can cause mild discomfort but does not cause any significant pain to the patient. There are no risks associated with an echocardiogram.

### **Limitations**

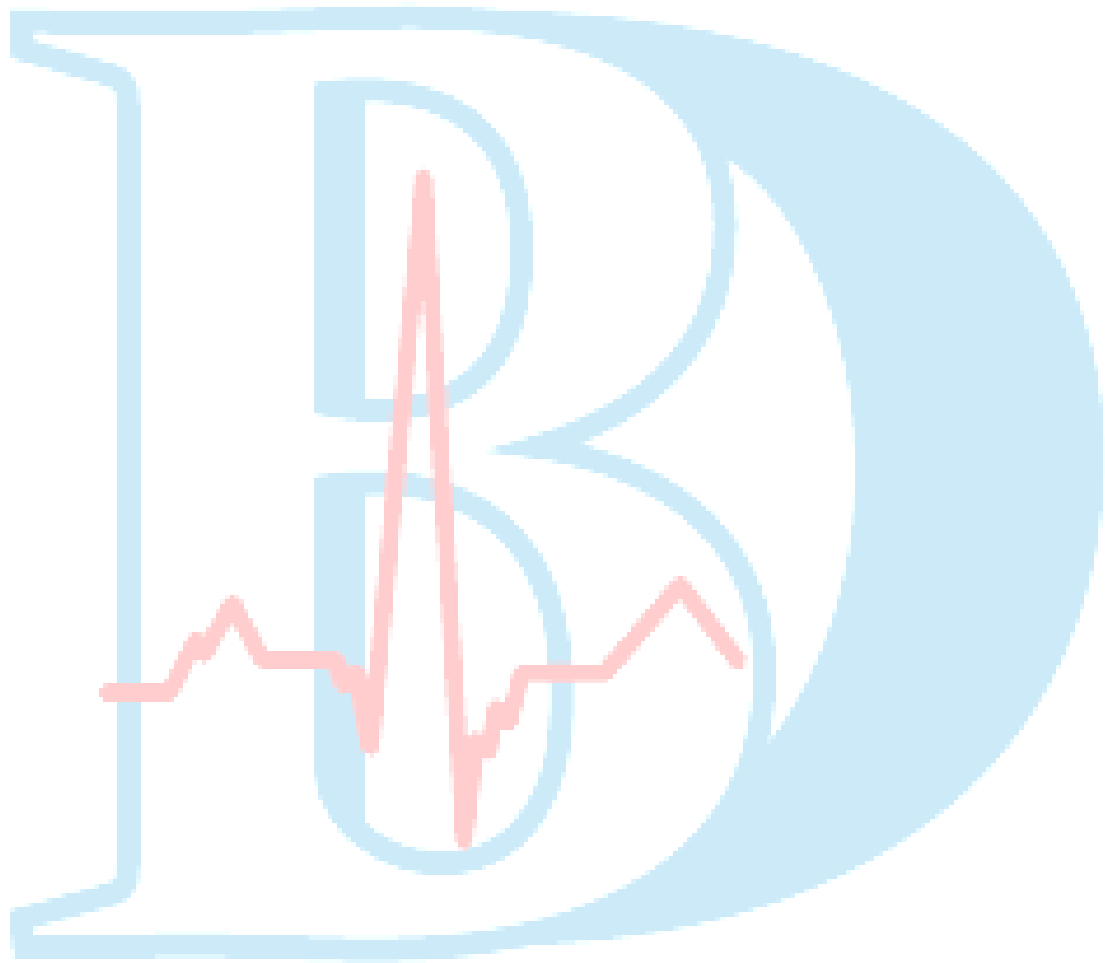
The echocardiogram provides a wealth of information, and in this day and age of cardiology, the test is indispensable. Despite this, the information obtained can be limited by body habitus and certain health conditions like lung disease, as the image quality can be poor. In patients who have gross structural abnormalities of the heart, it may be difficult to make an accurate assessment, in which case further tests may be required.

### **Special tests**



Echocardiography has advanced tremendously in recent years. Normal echocardiography is performed in 2-D, but newer machine can perform specialised measurements in 3-D. Furthermore, newer measures help assist in diagnosing valve problems and pumping function of the heart.

We currently offer 2-D echocardiography and a complete cardiac assessment at Baliga Diagnostics Pvt. Ltd.



## 8. Stress Echocardiogram

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A large number of patients with coronary artery disease may do not always present with symptoms when at rest. However, these may become manifest when the patient exert themselves e.g. taking a walk, climbing up a flight of stairs etc. During exercise, the heart arteries dilate so that more blood may be supplied to the heart muscle. However, when the arteries are narrowed due to disease, they do not dilate sufficiently, resulting in parts of the heart muscle not receiving adequate blood supply. Due to this, that particular part of the heart muscle may not move very well under stress, and this can be visualised on an echocardiogram. Please note that we currently do not offer this test at Baliga Diagnostics Pvt. Ltd.

### Preparing for the test

The recommendations are similar to the ones advised prior to performing an exercise test. In a nutshell:

- Avoid food intake for at least 4 hours prior to the test. Patients with diabetes should get advice from the treating physician.
- Patients may be asked to stop taking drugs that can alter the test results for a few days prior to the test.
- Wear comfortable shoes and clothing
- Once all the information has been provided, the patient will be asked to sign a consent form.

### How is it performed?

A stress echo is performed very much like an echocardiogram. However, there are 3 stages to the test:

- Resting echocardiogram
- Stress test – either a treadmill test, exercise bike, or drugs
- Repeat echocardiogram – when the heart is beating fast and hard

### *Resting echocardiogram*

The resting echocardiogram is performed exactly like a normal echocardiogram (see section 6). The patient is hooked up to the echo machine to monitor the heart, and images of the heart are taken and stored.

### *Stress test*

This can be either a treadmill test, and exercise bike test or a test conducted using certain drugs that speed up the heart.

The treadmill exercise test has been discussed previously. The aim of the test here is to increase the heart rate in order to produce enough stress on it to alter its blood supply. The heart rate and blood pressure will be monitored closely by the physician. Once the heart rate is suitably elevated, the exercise is terminated and a repeat echo is performed.

When drugs are administered instead of performing the treadmill test, a small needle called a cannula is inserted into a vein in the arm, through which a drip is commenced. The drip contains a drug (e.g. dobutamine, adenosine) that is injected in controlled amounts into the vein, while continuously monitoring the patient. The drug increases the heart rate gradually and the drip is stopped once the heart rate is suitably high.

### *Repeat echocardiogram*

With the heart rate still elevated, the patient is returned to the couch, and the heart is scanned again. During this scan, the physician will particularly notice whether any parts of the heart muscle are not moving well. This could indicate underlying problems with blood supply to that part of the heart.

The test takes around 1.5 to 2 hours to conduct, from start to finish. Once all the images are obtained, they are stored on a CD/DVD.

### **What information does the test provide?**

The resting echocardiogram provides information on structure of the heart muscle, valves and the lining of the heart (pericardium). In particular, the resting scan reveals any abnormal movements of different parts of the heart muscle when it is in a relaxed state.

Upon exercise or administration of drugs, the heart rate increases. When the heart rate increases, it requires more blood for it to function optimally. This does not occur if the blood supply is compromised due to narrowing of heart arteries, and this is reflected by reduced or abnormal movements in the heart muscle. In addition to this, it can provide information on problems with the heart valves or blood flow across it under stress.

By providing this information, the doctor is able to decide what treatment, if any, is appropriate, and if any further tests are required.

### **Safety of the test**

The test is relatively safe to perform. The patient may experience fatigue and breathlessness as is expected from the exercise test (on the treadmill or exercise bike). The test is continuously monitored by experienced technicians or a physician to handle any cardiac complications (like irregular rhythms, chest pains etc.) from the exercise tests. There are no risks associated with undergoing the heart scan.

### **Limitations**

Though the test indicates as to whether the blood supplying the heart muscle is compromised, it does not indicate clearly as to which artery is narrowed and to what extent. The treadmill test cannot be performed in patients who have problems with mobility (arthritis, knee pain, ankle pain etc.). In such patients, the dobutamine test can be used. However, dobutamine stress test is avoided in patients with a history of irregular heart rhythms.

Stress echo tests are also avoided in patients suffering from a heart attack and in patients who are acutely ill. On the discretion of the physician, it may be avoided in patients with severely narrowed heart valves or with very weak hearts.

Your doctor will only recommend the test if it will aid reaching a diagnosis.

## 9. Coronary angiogram

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A coronary angiogram is a test used to visualise the heart arteries with help of some dye and an x-ray machine. The test has been described in detail in our leaflet titled 'Coronary angiography'.

### How is it performed?

A coronary angiogram is often performed in a hospital setting. Prior to the procedure, the patient is offered information regarding the test and will have to sign a consent form agreeing to undergo the test.

The patient is laid on a surgical table in the angiography suite. The procedure is either performed through an artery in the leg (femoral artery) or an artery in the forearm (radial artery). The skin is cleaned with an antiseptic solution and the area is covered in sterile drapes, exposing only that part through which the procedure is performed. Local anaesthetic is administered into the skin and deeper tissues around the artery and a plastic sheath is inserted once the anaesthetic has taken effect.

Through this plastic sheath is inserted the angiography wires (also called catheters) which are directed under the guidance of x-ray to the coronary arteries. Once these wires are within the coronary arteries, a dye (also called contrast) is injected through these which brighten up the coronary arteries on x-ray. The image below shows what the coronary arteries look like when performing an angiogram.



**Figure: Coronary arteries as seen on coronary angiogram (image courtesy: Wikipedia)**

Multiple images are taken of both the right coronary artery and the left but no system. While taking these images, the x-ray machine may move in different directions in order to obtain images from different angles.

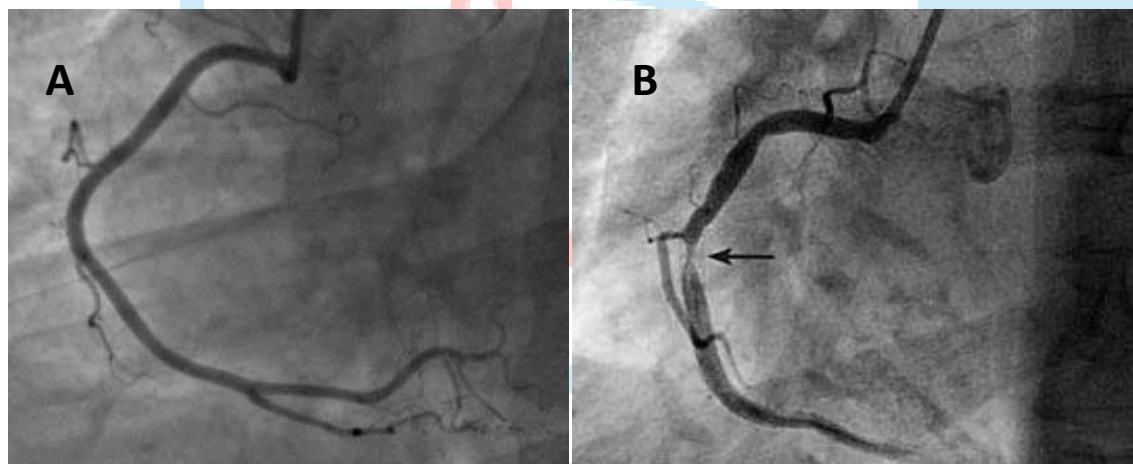
Once a sufficient number of images have been taken, the wires are removed and the sheath that is present within the artery is also taken out. Tight pressure is applied onto the artery for up to 10 min in order to stop any blood from leaking out of it.

Following the procedure, the patient is observed for a short period of time and is then discharged home.

The entire procedure can take between 30 min to an hour to complete.

### **What information does the test provide?**

Coronary angiography is an excellent test to assess the state of the coronary arteries. This is because the arteries are directly visualised while the heart is beating under the guidance of x-ray. Any narrowing in the heart arteries can be clearly seen as is shown in the pictures below –



**Figure – A) Normal right coronary artery. B) Tight narrowing in the middle of the right coronary artery. This can cause chest pain or a heart attack.**

### **Risks of the procedure**

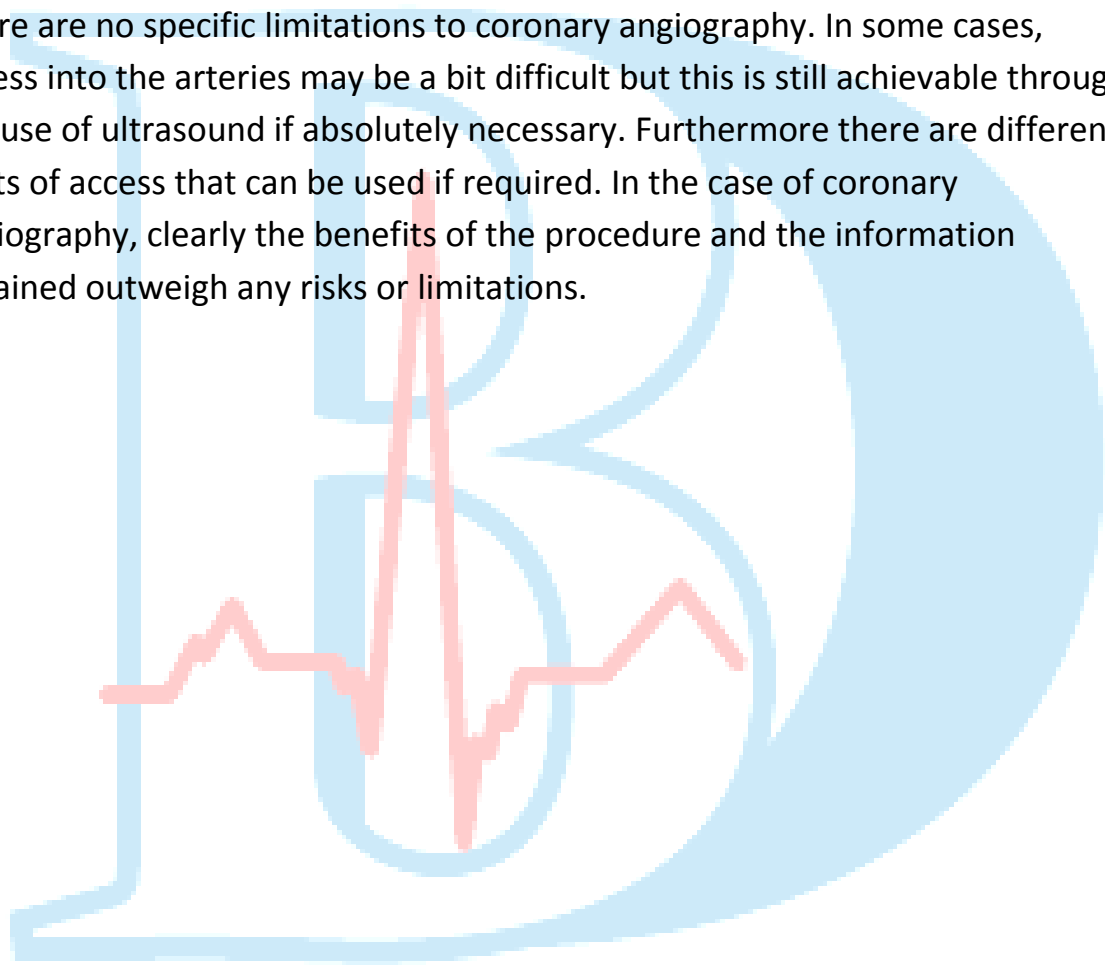
The common risks include mild bleeding and bruising at the site of injection and sheath insertion. On some occasions, patients may develop an allergic reaction to the contrast dye that is used in the procedure.



Sometimes, more serious complications such as heart attack or stroke may occur but these are extremely rare. Damage to the artery into which the sheath is inserted may also occur and may require treatment. There is the risk of death from the procedure as well but this is extremely rare. Studies have estimated any sort of serious complication to occur in around 1-2 in 1000 patients. If you have any concerns, always discuss this with your doctor before going ahead with the procedure.

### **Limitations**

There are no specific limitations to coronary angiography. In some cases, access into the arteries may be a bit difficult but this is still achievable through the use of ultrasound if absolutely necessary. Furthermore there are different ports of access that can be used if required. In the case of coronary angiography, clearly the benefits of the procedure and the information obtained outweigh any risks or limitations.

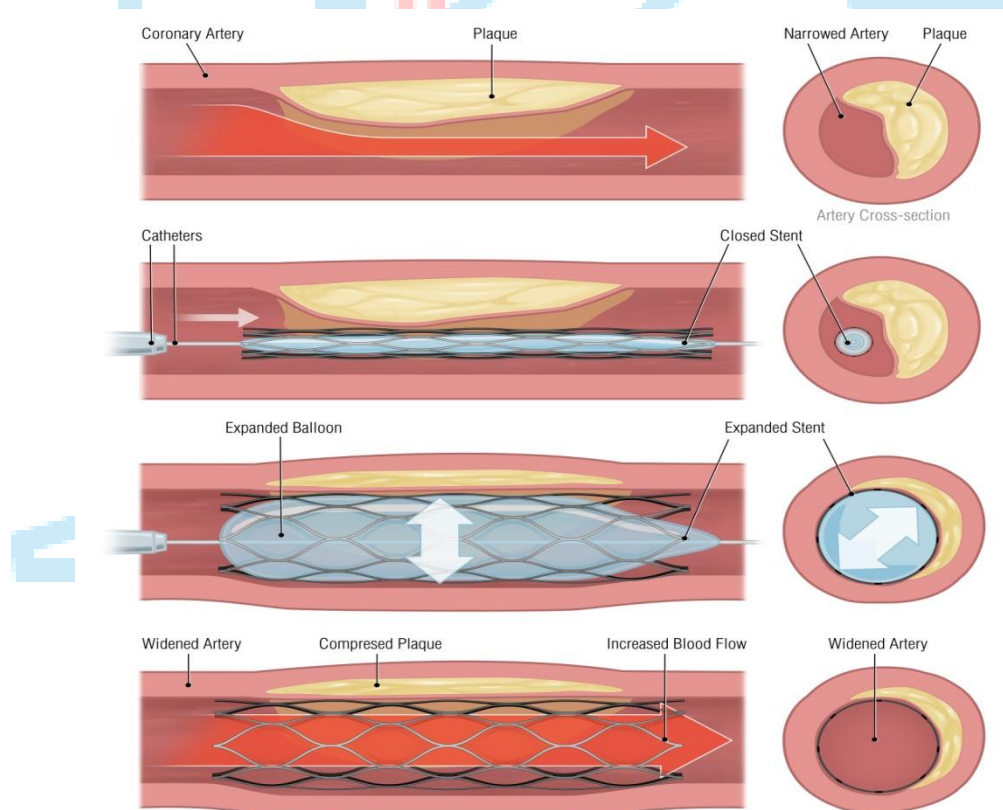


## 10. Coronary Angioplasty

Coronary angioplasty is a procedure where a narrowed coronary artery is opened up using a balloon and a stent. It is often offered to patients who have suffered from heart attacks or those who were experiencing constant chest pain on exertion or at rest.

### How was the procedure performed?

The procedure is extremely similar to a coronary angiogram. The only additional aspect to coronary angioplasty is that an additional wire that contains a balloon or a metallic stent is inserted through the sheath into the coronary artery that needs opening up. Once the balloon or stent is in place, it is inflated or expanded to open up the artery. The stent keeps the artery open allowing for normal blood flow through the coronary artery. The image below demonstrates how coronary angioplasty works.



**Figure – Coronary angioplasty. Notice how the balloon and stent open up the narrowed artery.**

The rest of the procedure following coronary angioplasty is similar to coronary angiography. The procedure takes around 30 to 45 min to perform though sometimes it may take longer if the coronary artery disease is a lot more complex and multiple interventions need to be performed.

During the procedure, as the balloon is inflated, the artery in which it is placed may be temporarily blocked off. Patients may experience mild chest discomfort when this occurs but it is reassuring to know that this only last for a few seconds and disappears once the balloon is deflated. Following the procedure, the cardiologist will ensure that the arteries are patent by injecting dye into them again. Patients are then moved to the observation area and are discharged home if there are no complications.

### **Limitations**

Coronary angioplasty may not necessarily be the best treatment option for patients who have coronary artery disease. Some patients may benefit from a bypass operation rather than undergo this procedure. Furthermore, this procedure is often not recommended to patients who suffer from kidney disease as the contrast dye can place pressure on this organ and cause it to not function normally.

### **Risks of the procedure**

The risks of coronary angioplasty are more than that of a coronary angiogram because the degree of manipulation within the artery is a lot more. Heart attacks may occur in around 1% of the cases and stroke may occur in 0.5% of cases. Patients may experience excessive bleeding from the site of the procedure. Death has been reported in around one in 500 cases.

It is important to recognise the fact that despite the risks, the procedure has benefits that outweigh them. In fact, coronary angioplasty can be life-saving treatment in patients suffering from an acute heart attack. Every patient who undergoes coronary angioplasty will have a full assessment to ensure that they are safe to undergo the procedure. The procedure will not be performed if any suspicion of high-risk is felt.

## 11. CT coronary angiogram

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A CT (computed tomography) coronary angiogram is a test that is very similar to the coronary angiogram, but performed using a machine called a CT scanner. In the past, CT scans were used to look at organs that are static in the body, such as brain, liver, spleen etc. However, more recently, CT scanners are able to view moving organs like the beating heart.

### When is it performed?

Nowadays, CT coronary angiograms are being performed more often, and may be preferred by some physicians over invasive coronary angiogram. Some of the indications include

- Angina
- Screening tests for family members of patients with heart disease
- Inconclusive exercise test
- Inability of patients to perform exercise tests
- Assessing coronary artery bypass grafts
- Physician preference

### How is it performed?

A CT scanner is a large dough-nut shaped machine that emits x-rays and takes images. In the case of a CT coronary angiogram, dye is injected into the heart arteries, and images are obtained at different levels of the heart. The test is painless and may take up to an hour to perform.

When in the department, a small needle called a cannula is placed in a vein in the arm. The patient is then asked to lie down onto a couch and images are taken. Dye can be injected into the heart arteries through the cannula, and further images can be taken if required.

### What information does the test provide?

The test is useful in assessing the patency of the heart arteries and detecting any narrowing or abnormalities in its structure. It does so by detecting fat deposits and calcium deposits in the heart arteries. Abnormalities can also be

detected in the heart muscle and heart valves as well, though this is not the primary aim of the test.

### **Limitations**

There are a few limitations to performing CT coronary angiography. Following a heart attack, the heart muscle tends to remodel itself in order to regain its function. When this happens, there may be distortion of the blood vessels around the heart making them difficult to study using this procedure. It is therefore not advised as a test if patients have significant underlying coronary artery disease. Instead, it is useful as a screening test in healthy patients who may be suffering from symptoms suggestive of angina.

Another limitation with this procedure is that it tends to overestimate how narrow a coronary artery is when compared to invasive coronary angiography. In addition to this, while it may show narrowing of the artery, it does not necessarily indicate how the artery itself is functioning.

Finally, patients who are allergic to iodine are not suitable to undergo this test.

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### **Further Reading**

For further information on different kind the investigations and how they can be arranged, please visit our website at [www.baligadiagnostics.com](http://www.baligadiagnostics.com).