

ELECTROPHYSIOLOGY STUDY AND RADIOFREQUENCY ABLATION

This information is not intended to replace professional medical care. Only your doctor can diagnose and treat medical problems.

Your doctor has recommended that you undergo an electrophysiology (EP) study and radiofrequency (RF) ablation. You and your family probably have some questions and concerns about this procedure. This information sheet can help answer many of your questions.

What is an EP Study?

An EP Study is an accurate method for assessing the heart's electrical function. It allows doctors to locate abnormal sites inside the heart that may be causing serious arrhythmias (abnormal heart rhythms).

During an EP study, doctors place special catheters (flexible wires) into veins and guide them into the heart. Once inside, the catheters can sense electrical impulses in various areas of the heart; they can also be used to stimulate different parts of the heart.

Why Is the EP Study Important?

The EP study provides much more accurate and detailed information about the heart's electrical function than other tests. It helps doctors diagnose the problem accurately and enables them to choose the most effective treatment.

EP studies are most useful in people who have had life-threatening or clinically important arrhythmias and in people with persistent symptoms in whom suspected arrhythmias cannot be diagnosed with other tests.

BACKGROUND: HOW THE HEART WORKS

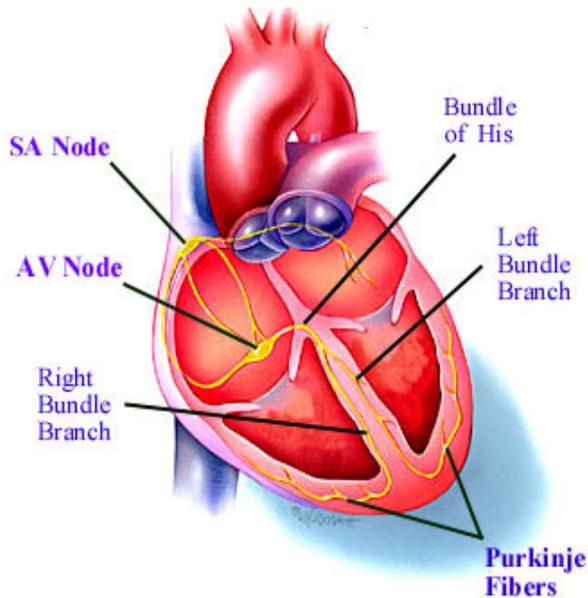
Before discussing the details of the EP study, it helps to understand how the heart works.

The Heart as a Pump

The heart is a muscular, hollow organ that constantly pumps blood throughout the body. The heart is made up of four compartments or chambers. There are two chambers on the "left side" and two on the "right side". The upper chamber on each side, called an **atrium** (plural: atria), receives and collects blood. The lower chamber on each side, called a **ventricle**, pumps blood. The four heart chambers work together to contract and pump blood. As it circulates, blood delivers oxygen and nutrients throughout the body.

The Heart's Electrical System

The heart's rhythmic contractions depend on its electrical system which conducts electrical impulses throughout the heart. The **sinoatrial (SA) node**, a group of specialized cells in the right atrium, is the place where the electrical impulse normally begins. The SA node functions as the heart's "natural pacemaker", setting the pace for the heartbeat. The electrical impulse travels a set path and spreads throughout the atria, causing them to contract and squeeze blood into the ventricles. From the atria, the electrical impulse reaches the atrioventricular node, or **AV node**, which is located between the atria and the ventricles. The AV node is like a "relay station", slowing down each electrical impulse before it is allowed to pass through the ventricles. The impulse then travels to the ventricles through a system of specialised fibres. The system divides into a network of smaller fibres that distribute the impulse throughout both ventricles. The impulse stimulates the ventricles, causing them to contract and pump blood.



The Electrical System of The Heart

ABNORMAL HEART RHYTHMS

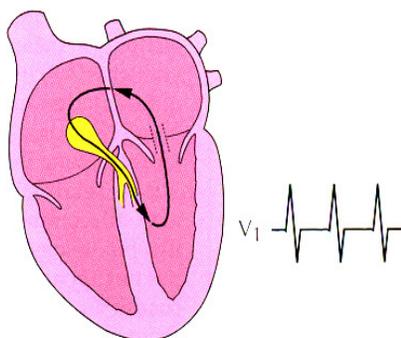
An abnormal heart rhythm, or **arrhythmia**, is a change in either the speed or pattern of the heartbeat. During an arrhythmia, the heart may beat too slowly, too rapidly, or irregularly. An arrhythmia may be experienced as a skipping or rapid fluttering sensation in the chest (palpitations). It may also cause light-headedness, a blackout, chest pain or shortness of breath. Sometimes, arrhythmias may go unnoticed. An arrhythmia becomes serious when the heart beats too slowly or too rapidly to pump blood effectively. Arrhythmias may occasionally be a threat to a person's life.

Rapid Heart Rhythms

Supraventricular Tachycardia (SVT): SVT is a series of very rapid heartbeats that begin in the heart's upper chambers. SVT may occur when an extra electrical connection exists in the atria, the AV node or between the atria and ventricles. Alternatively, sometimes an extra focus may develop in the atria which beats rapidly and independently of the normal SA node.

AV nodal re-entrant tachycardia (AVNRT) is the most common form of SVT. In this condition, an extra pathway exists in or next to the AV node. If an electrical impulse enters this pathway, it may start traveling in a circular pattern. This may cause the heart to contract with each cycle, and may result in a very rapid, regular heartbeat.

Wolff-Parkinson-White Syndrome (WPW): In WPW, an abnormal "bridge" of tissue connects the atria and ventricles. This extra pathway, called an accessory pathway, makes it possible for electrical impulses to travel from the atria to the ventricles without going through the AV node. In people with WPW an arrhythmia can get started when an impulse travels down the AV node to the ventricles, and then up through the accessory pathway to the atria. If the impulse continues to travel in a circular pattern, it may cause the heart to contract with each cycle and may result in a very rapid heartbeat. Because it is prone to conduct impulses rapidly, an accessory pathway may also allow extremely rapid and potentially serious rhythms to occur. This condition can occasionally result in sudden death.



Abnormal circuit in WPW

Atrial Tachycardia: Sometimes, a small region of heart tissue starts beating very rapidly and takes over the usual pacemaker of the heart. Atrial tachycardia is the rarest form of SVT and may come and go or be continuous.

Atrial Flutter: Atrial flutter is caused by an abnormal circuit in the right atrium which leads to very rapid regular atrial contractions at 300 per minute – fortunately, usually only every second beat goes down to the ventricles and the heart rate is around 150 per minute. In some cases the heart rate may be slower and in other cases it may reach rates of 250-300 per minute. Atrial flutter may occur once in a while or may be long-standing (chronic). Atrial flutter may cause clots to develop in the heart. These can dislodge and cause strokes.

Atrial Fibrillation (AF): In AF, multiple short circuits develop in the atria and specific sites in the left atrium fire impulses in fast and uncoordinated fashion. As a result the atria beat very quickly and ineffectively. The AV node, which acts as a “relay station” allows only some of these impulses to travel down the electrical system and stimulate the ventricles. The heart rhythm is irregular, erratic and usually (but not always) rapid. Atrial fibrillation may occur once in a while or it may be long-standing (chronic). AF may cause clots to form in the heart. These may dislodge and cause strokes.

Ventricular Arrhythmias:-

Ventricular Tachycardia (VT): With VT, abnormal electrical pathways exist in the ventricles, usually in an area of heart muscle that has been damaged by a heart attack or a virus. If an electrical signal enters such a pathway, it may start travelling in a circular pattern. This may cause the ventricles to contract with each cycle, and may result in a very rapid heartbeat. This type of VT often tends not to stop by itself. Even worse, it can sometimes deteriorate into a chaotic rhythm called ventricular fibrillation which leads to a fatal cardiac arrest.

Ventricular Fibrillation (VF): Ventricular fibrillation results when multiple rapid circuits in the ventricles develop and the heart beats in an uncoordinated fashion. As a result, the ventricles quiver and cease to pump blood effectively, thereby stopping the circulation of blood. Death follows within a few minutes unless a normal rhythm is restored with emergency treatment.

Slow Heart Rhythms

Sick Sinus Syndrome

In this condition, the sinus node fails to perform its role as the heart’s natural pacemaker. It may not send electrical signals often enough, may skip some signals, or may send too many signals all at once. As a result the heart may beat too slowly (sinus bradycardia), pause for too long (sinus pause), or may alternate between being too slow and too fast (bradycardia-tachycardia syndrome).

Heart Block

In heart block, there is an interruption of the pathway through which impulses travel to the ventricles. The interruption can be either partial or complete. In complete heart block, *all* impulses coming from the sinus node are blocked and fail to reach the ventricles. The ventricles may be stimulated by a “backup pacemaker”, which is slower and less reliable than the sinus node. Heart block may result in a very slow, unreliable heartbeat and the heart may even stop completely.

PREPARING FOR YOUR EP STUDY

Unless you are already hospitalised, you will be admitted to hospital for the study.

Before your EP Study

- Generally you will be asked not to eat or drink anything for 6 hours before the procedure. (You may have sips of water to swallow your medications).
- Make arrangements with a family member or friend to drive you to the hospital.
- If you haven’t received instructions for admission and hospital admission papers several days before the EP study, please check with your doctor’s rooms. You may be asked to stop taking certain medications for 4-5 days before the procedure and it is important that you know which ones to stop.
- Bring a list of all the medications you are currently taking. It is important for the doctor to know the exact names and dosages of any medications that you take.
- Be sure to mention to the doctor (or nurse) if you have experienced allergic reactions to any medications.

After admission to hospital, several **routine blood tests** will be performed including an ECG. You will then be asked to sign a consent form. A nurse will shave and clean the area where the catheters will be inserted. In most cases this will be the right groin and in some cases, the right neck area. An **intravenous needle** ("IV line") will be inserted into a vein in your arm. It allows medication to be injected directly into the vein, if necessary. You may also be given a sedative to help you relax. Procedures are performed either under **local anaesthetic** or **general anaesthetic** and this may be decided at the time of the procedure. Occasionally a needle may be introduced into a wrist artery to help monitor blood pressure during the EP study.

DURING THE PROCEDURE

The EP study is performed in a specially equipped room called an **EP lab**. You will be transported to the EP lab on a movable bed and then transferred to an x-ray table. The table has a large camera above it and television screens close by. The equipment in the EP lab also includes heart monitors and various instruments and devices. The EP lab team generally includes the Electrophysiologist (a doctor with special training), an assistant, nurses and technicians. With many procedures, an anaesthetist is also involved. After being positioned on the x-ray table, you'll be connected to a variety of monitors, and covered with sterile sheets.

What Happens During the EP Study

The areas where the catheters are inserted (groin or neck) are cleaned thoroughly. A local anaesthetic is injected into the skin with a tiny needle to numb the area. A needle is used to puncture the blood vessel (usually a vein) into which the catheters will be inserted. The special **electrode catheters** used for the EP study are long and flexible wires that can conduct electrical impulses to and from the heart. One or more catheters are inserted into the body and advanced toward the heart while the staff follows their progress on a television screen. The catheters are then positioned inside the heart. There are no nerves inside the heart and so this does not cause any discomfort.

How the EP Study Is Done

In general terms, the EP study is performed by doing two basic things:

Recording Electrical Signals. Electrode catheters sense electrical activity in various areas of the heart and measure how fast electrical impulses travel.

Pacing the Heart. Electrode catheters can also be used to deliver tiny electrical impulses to pace the heart. By doing so, doctors try to **induce** (bring on) certain abnormal heart rhythms so that they can be observed under controlled conditions.

The EP study helps define the exact location of the heart's abnormal electrical activity (this part of the study is called "mapping"). The location and type of arrhythmia you have will help determine the best treatment option for your problem.

What You Can Expect During the Study

If the EP procedure is performed under local anaesthetic, you will be awake - although medication may be given to help you relax (it's not uncommon to doze off during the procedure). The staff will be monitoring your progress constantly. The EP study is **not painful**, although you may feel some pressure at the insertion site(s) during the placement of the catheters. There also may be some discomfort from lying still for a long time. You will not feel the catheters moving through the blood vessels and into your heart. If the EP study is performed under general anaesthetic, you will be asleep throughout the procedure.

During the procedure doctors may stimulate your heart with tiny electrical impulses. You will not feel these impulses but they may induce the arrhythmia that has caused your symptoms in the past. The procedure duration is variable – some studies are complete within 30 minutes; others may take 1-2 hours.

Is the EP Study Safe?

An EP study is an "invasive" procedure that requires the insertion of catheters *into* the body. It therefore involves some risk. The *risk is small*, however, and the EP study is considered very safe. Some patients may develop

bruising at the insertion site. Less frequently, EP studies may be associated with more serious complications. These include damage to the heart, blood vessels or normal conduction system of the heart, formation of blood clots and infection. Major complications such as a heart attack or stroke or death are extremely rare. Although most patients who undergo EP studies do not experience problems, you should be aware of the risk. Each type of EP procedure may have potential complications peculiar to it – these will be addressed when the doctor explains the study in detail to you.

CATHETER (RF) ABLATION

The EP study and catheter ablation are very similar procedures. In fact *your doctor may decide to do both procedures, one after the other*, while you are in the EP lab. This possibility will be discussed with you prior to the study. Catheter ablation is a non-surgical technique that heats parts of the abnormal electrical pathway that is causing your *rapid* heart rhythm. During catheter ablation, doctors insert a special catheter into the heart. They position the catheter so that it lies close to the abnormal electrical pathway, then pass radiofrequency (heat) energy through it. The tip of the catheter heats up and destroys (ablates) the small area of heart tissue that contains the abnormal pathway.

AFTER THE EP STUDY

After the procedure is completed and the catheters are removed, firm pressure will be applied to the insertion site for about 10 minutes. This is done to prevent bruising. You'll be transported to your room or the recovery area. Whether you are allowed to eat or drink soon after the study depends on your condition. Back in your room, ***you'll lie flat in bed for 2 hours*** (occasionally longer), to allow a small seal to form over the puncture in the blood vessel. During that time, do not bend or lift the leg where the catheters were inserted. To relieve stiffness, you may move your foot or wiggle your toes.

The nurse will check your pulse and blood pressure frequently, and will also keep checking the site(s) where the catheters were inserted. If you feel sudden pain at the site or if you notice bleeding, ***notify the nurse immediately***.

The doctor who performed the study may be able to discuss with you some of the test findings soon after the procedure. A complete, detailed analysis of all of the measurements will take more time. Depending upon the results of the study, you may be sent home after several hours of observation, or the next day. When it's time to go home have a friend or family member drive you.

At Home, After Your EP Study

- To reduce the risk of a clot forming in the leg veins following the EP study, injections of a blood thinning agent may be given for several days.
- Rest and limit your activity during the first 48 hours after you return home. You can move about but do not strain or lift heavy objects.
- A bruise under the skin at the insertion site is common. This generally disappears within 2 weeks.
- For further information, please refer to the "After You Leave Hospital" leaflet provided with your hospital admission instructions.

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