Understanding Electrophysiology Studies

- Problems with Your Heart’s Electrical System
- Role of an Electrophysiology Study
- Treatment Options
A Problem with Your Heart Rhythm

Your heart has an electrical system that controls the speed and pattern of your heartbeat (**heart rhythm**). Problems with this system can make your heart beat too slowly or too quickly. They can also cause symptoms such as dizziness or shortness of breath. If your doctor suspects that you have a heart rhythm problem (**arrhythmia**), he or she may order an **electrophysiology (EP) study** to learn more about your heart.

How an Electrophysiology Study Can Help

An EP study is a procedure that gives information about your heart’s electrical system. During the procedure, thin tubes (catheters) are inserted into a blood vessel and carefully guided into your heart with the help of x-ray pictures. The electrical activity and the electrical pathways in your heart are then recorded and mapped out. The results can help determine the cause of your heart rhythm problem and what can be done to control it. Your doctor can discuss what an EP study means for you.
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**Key Points**

- The heart’s electrical system is an important and integral part of your heart’s function.

- Problems with this system can be diagnosed and treated by a type of cardiologist (heart doctor) called an **electrophysiologist**.
A Normal Heart Rhythm

Your heart is a muscle that pumps blood throughout your body. The heart muscle beats (contracts and relaxes) many times a minute. The speed and pattern at which the heart beats is known as your heart rhythm. Signals from the heart’s electrical system control this rhythm. A problem with these signals may cause an abnormal heart rhythm.

Your Heart as a Pump

Your heart contains four chambers. These chambers hold blood as it moves through the heart. The two upper chambers (atria) receive blood from the lungs and body. The atria contract to move blood into the two lower chambers (ventricles). Then the ventricles contract to move blood out to your lungs and body.
Your Heart’s Electrical System

Your heart’s electrical system controls your heart rhythm with electrical signals. Groups of special electrical cells called nodes create or send these electrical signals. As the signals move through the heart, they tell the chambers when to contract and move blood. The signals start in the right atrium in the SA node. They then travel through the atria and to the AV node. The AV node passes the signals to the ventricles along special pathways called bundle branches.

The SA (sinoatrial, or sinus) node is the heart’s natural pacemaker. It starts each heartbeat by sending an electrical signal that tells the atria to contract.

The AV node receives the signal from the SA node after the signal passes through the atria. The AV node then guides the signal to the ventricles.

The bundle branches are pathways of cells that carry the signal through the ventricles. As the signal moves through the ventricles, they contract.
Symptoms of a Heart Rhythm Problem

A heart rhythm problem affects how well the heart contracts and pumps blood. If your heart rhythm is too slow or too fast, the change in blood flow can cause symptoms ranging from mild to severe. These symptoms can include:

- Palpitations (a fluttering, strong, or fast heartbeat)
- Dizziness or lightheadedness
- Fainting or blackout spells (syncope)
- Shortness of breath or throat tightness
- Weakness
- Inability to perform usual amount of physical activity (exercise intolerance)
- Chest pain or discomfort
Slow Heart Rhythms

A slow heart rhythm is called bradycardia. It can occur when the heart’s electrical signals are too slow, not sent, blocked, or go the wrong way. As a result, the heart can’t pump blood well. Blood doesn’t move through the heart and to the body the way it should. This may happen frequently or only from time to time (intermittent).

SA Node Problems

The SA node sets the pace of the heart rhythm. If the SA node doesn’t send signals often enough or skips some signals, the atria don’t contract properly. This makes the heart rhythm too slow. There are several types of SA node problems:

- With sinus bradycardia, the signals from the SA node are too slow.
- With tachy-brady syndrome, the signals alternate between being too fast and too slow.
- With sinus pause, the signals stop from time to time.

AV Node or Bundle Branch Problems

Electrical signals travel from the atria to the ventricles through the AV node and the bundle branches. If the signal doesn’t leave the AV node or move along the bundle branches, the ventricles don’t contract properly. This makes the heart rhythm too slow. A problem with the signal at the AV node or both bundle branches is called heart block. Heart block may be intermittent.
Fast Heart Rhythms

A fast heart rhythm is called **tachycardia**. It can occur when the heart’s electrical signals are too fast. Or, it can happen if signals travel along abnormal pathways, forming extra circuits. It can also happen if signals start in abnormally charged areas or cells in the heart. Fast heart rhythms can affect the atria, ventricles, or both.

**Supraventricular Tachycardia (SVT)**

SVT is a series of very fast heart contractions that begin in the atria. Following are common SVTs that can be diagnosed by an EP study.

**Wolff-Parkinson-White (WPW) Syndrome**

With WPW, an extra pathway exists between the atria and ventricles. This extra pathway is also called an **accessory pathway** or **bypass tract**. Signals that pass through the AV node may reach the accessory pathway and travel back to the atria, forming a big circuit. This causes contractions that speed up the heart rate.

**AV Nodal Reentrant Tachycardia (AVNRT)**

With AVNRT, the AV node is split into two pathways. These pathways can form a small **circuit**. If the circuit is activated, the atria and ventricles contract repeatedly. This causes the heart rate to speed up suddenly.
Atrial Fibrillation

With atrial fibrillation, the atria receive abnormal signals. These signals are most often sent by cells in the pulmonary veins, near where the veins connect to the heart. The abnormal signals cause the atria to contract very quickly and irregularly. This can happen all the time (permanent). Or, it can just happen once in a while (paroxysmal).

Ventricular Tachycardia (VT) and Ventricular Fibrillation (VF)

The ventricles do most of the work to pump blood to the body. So, fast rhythms in the ventricles are often more serious than those in the atria. With VT, abnormal electrical activity or circuits develop in the ventricles. This usually occurs in areas of damaged heart muscle or cells. VT makes the heart beat very fast, causing the heart to pump ineffectively. It can develop into the most serious arrhythmia called ventricular fibrillation (VF). VF is a chaotic, fast, irregular rhythm. This causes the heart to pump little to no blood. Both VT and VF can lead to cardiac arrest, which is life threatening. It must be treated right away.

Atrial Flutter

Atrial flutter is often mentioned with atrial fibrillation because they have similar symptoms and medical treatments. Atrial flutter can occur when an abnormal circuit exists in the right atrium, causing a very fast heartbeat.
Preparing for Your Electrophysiology Study

An EP study is performed by an electrophysiologist. This doctor has specialized training in diagnosing and treating electrical problems in the heart. The procedure usually takes place in an EP laboratory at a hospital. Before your EP study, you’ll meet with the doctor to go over the procedure. If you have questions, be sure to ask during this visit.

Before the Procedure

To prepare for your EP study:

- Have any routine tests that your doctor recommends. These can include a chest x-ray or blood tests to check your general health. A separate appointment will need to be made to have these tests.

- Tell your doctor about any medications you take. This is especially important if you are taking a blood thinner, such as warfarin, diabetes medication, or a heart rhythm medication (antiarrhythmic).

- Follow all specific food, drink, and medication instructions you receive to prepare for the procedure.

- Arrange for an adult family member or friend to give you a ride home after the procedure.

Risks and Possible Complications

Your doctor will go over the risks and possible complications of an EP study with you before the procedure. They include:

- Bruising
- Bleeding
- Blood clots
- Collapsed lung (pneumothorax)
- Perforation of the heart muscle or a blood vessel
- Stroke or heart attack (very rare)
- Death (extremely rare)
In the Electrophysiology Lab
Following is what you will likely see in an EP lab:

- **The x-ray equipment** sends x-rays (fluoroscopy) to create pictures that are viewed on monitors.
- **Video monitors** show the x-ray pictures, which are used to guide the catheters to your heart.
- **The ECG monitor** continuously shows your heart rhythm.

The Day of the Procedure
Be sure to arrive at the hospital on time. Here’s what to expect:

- You’re asked to sign some forms and change into a hospital gown.
- The skin on your groin, neck, chest, or arm is cleaned.
- You’re covered with sterile sheets. Only the area of skin where the catheters will be inserted is exposed.
- An IV (intravenous) line is started in your arm. It delivers fluids and medications, such as pain relievers, sedatives, or anesthesia, to your body. These help you relax and prevent pain or discomfort during the procedure. They’ll also make you very drowsy.
During Your Electrophysiology Study

An EP study usually takes several hours. In many cases, treatment called\textit{catheter ablation} is performed with an EP study to treat an arrhythmia. The doctor is assisted by a team of nurses, technologists, and other staff. If you feel any discomfort during the procedure, be sure to tell someone on your healthcare team.

Inserting the Wires
Electrode catheters are used for an EP study. The area where the catheters are inserted is numbed with anesthetic so you won’t feel pain. A small puncture is made in a blood vessel (vein or artery). The catheters are then inserted and moved through the blood vessel toward the heart. Their movement is monitored on a video screen. The catheters are then positioned in the heart. You won’t feel them moving through your blood vessels or heart.

Studying Your Heart Rhythm
Electrode catheters are used to find where and when electrical signals begin, how often they’re sent, and what pathways they travel. Besides catheter ablation, the following can also be done during your procedure:

- Your heart can be stimulated by electrical signals sent through the catheters. If these signals start (induce) an arrhythmia, the electrical activity is recorded.
- If you do have an arrhythmia, the catheters can be used to identify (map) where the abnormal signals are coming from.
- Arrhythmias may be stopped by using the catheters to regulate (pace) the heartbeat. Sometimes the heart is given an electric shock (defibrillation) to stop an arrhythmia.
- The catheters can be used to assess your electrical system to see if a device called a pacemaker is needed.
After Your Electrophysiology Study

Once the EP study is completed, the catheters are removed. Pressure is applied to the insertion site and a dressing is placed over the area. No stitches are needed. You’ll remain lying down for several hours and be monitored by nursing staff. You may be discharged from the hospital the same day or you may be admitted overnight.

Learning Your Results
The doctor will discuss results with you in the hospital. The study, along with other test results, may provide enough information for your doctor to develop a treatment plan, if needed.

Recovering at Home
Most people can return to their normal routine in a day or two. Avoid heavy lifting and do only light activities for a few days. You may find a small bruise or lump under your skin at the insertion site. This is common and should go away within a few weeks.

When to Call the Doctor
After the procedure, call the doctor if you have any of the following:

- Unusual redness, swelling, bruising, bleeding, or discomfort at the catheter insertion site
- Numbness, tingling, or swelling in the arm or leg in which the catheters were inserted
- Shortness of breath
- Chest pain
- Fever of 101°F (38.3°C) or higher
- Abnormal heart rhythm that continues or worsens after the study
Treating Your Heart Rhythm Problem

The information from your EP study can help your doctor plan your treatment. In some cases, no treatment is needed. In other cases, medications, catheter ablation, or the placement of a device may be needed. Certain treatments, such as catheter ablation, may have already been performed during your EP study.

Medications

If medications can help control your arrhythmia, your doctor will choose the type that’s best for you. One common medication type is called an antiarrhythmic, which helps to maintain a normal heart rhythm. Be sure to take any medications you’re prescribed exactly as instructed. Also, keep the doctor informed about any medications you’re prescribed by other healthcare providers.

Catheter Ablation

Catheter ablation destroys (ablates) an abnormal electrical pathway or group of electrical cells that may be causing an arrhythmia. During the procedure, an ablating electrode catheter is placed in the heart. Radio frequency waves (or another form of energy) are then sent through the catheter to destroy the abnormal pathway or cells. This is a common treatment for heart rhythm problems such as atrial fibrillation, atrial flutter, and other SVTs.
Placement of a Device
Following are common devices that may be needed to help manage your arrhythmia:

- **A pacemaker** helps treat a slow heart rhythm. It is a small, lightweight electronic device that’s placed permanently inside your body. A pacemaker keeps track of your heartbeat. When needed, it generates electrical signals similar to the heart’s natural signals. These signals keep your heart beating at the right pace. Lifelong regular checkups help make sure that your pacemaker continues to run smoothly.

- **An implantable cardioverter defibrillator (ICD)** helps treat certain dangerous fast heart rhythms. It is an electronic device placed permanently inside your body. Like a pacemaker, the ICD continuously monitors your heart rhythm. If it senses your heart is beating too fast, the ICD can pace the heart to painlessly stop the fast heart rhythm. If needed, the ICD can also send out one or more electric shocks to return the heart to its normal rhythm. Lifelong follow-up with the doctor is needed to be sure that your ICD continues to work correctly. Your doctor will also monitor you for any further changes in your heart rhythm.

*A pacemaker or ICD is generally implanted under the skin in the chest, just below the collarbone.*
Going Forward

Electrophysiology studies can give your doctor the information needed to develop the best treatment plan for your heart rhythm problem. Once your abnormal heart rhythm is under control, you can get on with living your life to the fullest.