Electrophysiology study (EPS)

The normal electrical system of the heart
The heart has its own electrical conduction system. The conduction system sends signals throughout the upper chambers (atria) and lower chambers (ventricles) of the heart to make it beat in a regular, coordinated rhythm. The conduction system consists of two nodes that contain conduction cells and special pathways that transmit the impulse.

A normal heartbeat begins when an electrical impulse is fired from the sinus node (also called sino-atrial or SA node), in the right atrium. The sinus node is responsible for setting the rate and rhythm of the heart and is therefore referred to as the heart’s pacemaker.

The electrical impulse fired from the SA node spreads throughout the atria, causing them to contract and squeeze blood into the ventricles. The electrical impulse then reaches the atrioventricular node (AV node), which acts as a gateway, slowing and regulating the impulses travelling between the atria and the ventricles. As the impulse travels down the pathways into the ventricles the heart contracts and pumps blood around the body. The cycle then begins again.

A normal adult heart beats in a regular pattern 60 to 100 times a minute; this is called sinus rhythm.

Diagram of the heart’s electrical system

Arrhythmia
Sometimes if the conduction pathway is damaged, blocked, or an extra pathway exists the heart’s rhythm changes. The heart may beat too quickly (tachycardia), too slowly (bradycardia) or irregularly. This may affect the heart’s ability to pump blood around the body. These abnormal heartbeats are known as arrhythmias. Arrhythmias can occur in the atria or in the ventricles. Not all arrhythmias are dangerous; some can be just a nuisance.
Electrophysiology studies (EPS)
Your doctor has decided that an abnormal heart rhythm may be the cause of your symptoms. To find out more about your heart rhythm disturbance (arrhythmia) and to decide what will be the most effective treatment for you, your doctor has advised you to have an electrophysiology study (EPS).

An EPS provides your doctor with information about your heart’s electrical system. It is done to find out why your heart beats too quickly, or why it does not beat in a regular pattern. This may be due to an extra electrical pathway or area of conduction within your heart.

Your doctor will recommend you have an EPS when other tests cannot provide enough information to diagnose your arrhythmia.

The procedure
An EPS is a catheter technique where flexible wires (catheter electrodes) are passed through a vein in your groin (or rarely through the vein under your collarbone) and carefully placed at specific positions within your heart to record the electrical signals (activity). An EPS records how your heart reacts to extra electrical signals (paced beats) delivered within the different areas of the heart. This allows your doctor to collect detailed information about the cause of your arrhythmia and choose the most appropriate treatment for you. An EPS may also be performed in combination with a procedure called radio-frequency catheter ablation. This procedure is performed under a local anaesthetic, with sedation, which will help you to relax.

X-ray screening will be used during the procedure so if you think you may be pregnant you should let us know before the procedure.

Risks of the procedure
An EPS is safe however, as with any procedure there are potential risks. The risks will be fully explained by your doctor before you have your procedure. An EPS is performed safely in both children and adults.

If you are known to have underlying coronary heart disease the risks are slightly increased.

All the risks outlined below can be treated and are rarely life threatening.

• Blood vessel damage: occasionally the catheter electrodes can accidentally damage the blood vessels when being moved into position within the heart. The risk of this happening to you is between 3% and 5%. Serious injury to the blood vessels requiring a surgical procedure to repair the damage is extremely rare and occurs in less than 1% of patients.

• Pneumothorax: (if the vein under your collarbone is used) very occasionally the catheter electrodes can puncture the lung wall. Air leaks out of the lungs and collects in the space between the lung and chest wall, resulting in partial or complete collapse of the lung. If this happens the doctor may need to insert a drain to re-inflate your lungs. The risk of this happening to you is less than 1%.

• Haemothorax: (if the vein under your collarbone is used) very occasionally the catheter electrodes can puncture the lung wall. Blood leaks out of the lungs into the pleural cavity, the space between the lungs and the walls of the chest. If this happens the doctor will need to insert a drain to reinflate your lungs. The risk of this happening to you is less than 1%.

• Pulmonary embolism or stroke: the risk of developing blood clots that travel to the lungs or brain is extremely rare, less than 1%.
• Palpitations: it is common to experience palpitations (extra heart beats) during the procedure due to the catheter electrodes stimulating your heart. Your heartbeat will usually return to its normal rhythm very quickly without needing further treatment. However, very occasionally extra treatment (cardioversion) is needed to correct your arrhythmia. Cardioversion is a treatment for heart rhythms that are irregular. You will be given a short-acting sedative to make you sleepy. Once you are asleep a defibrillator is used to send electrical energy to the heart muscle to restore the normal rhythm and rate.

• Cardiac tamponade: during placement the catheters may puncture the heart muscle causing blood to collect around the heart. If this happens the doctor may need to insert a drain to remove it. The risk of this happening to you is less than 1%.

• Bruising and bleeding: this is common in the groin following the procedure. However, this usually disappears within a week and does not cause a problem.

Before admission
If you are taking medication to control your heart rhythm the admission coordinator may advise you to stop taking your tablets five days before your procedure. This is to allow your doctor to make a better assessment of your heart rhythm. Stopping your tablets may cause your symptoms to return.

If you are taking warfarin (blood thinner) regular blood tests will be needed for at least four weeks before the procedure, usually at your doctor’s surgery. We ask that you keep your INR between 2.0 and 3.0. A record of this should be kept in your yellow warfarin book. We also request that you check your INR three days before your admission to confirm it is in this range to enable the procedure to go ahead.

The above advice should be followed unless your admissions letter advises otherwise.

Before the procedure
When you arrive on the ward a nurse will talk to you and your family about your hospital admission and answer any questions you may have. Before the procedure, you will have blood tests taken and an electrocardiogram (ECG) recorded. A doctor will see you to explain the procedure to you and ask you to sign a consent form. This is to ensure you understand the procedure and the associated risks. If you have any worries or questions please do not be afraid to ask. It is important to tell your nurse or doctor if you have any allergies or have had a previous reaction to drugs or other tests. If you are having the procedure done under a general anaesthetic, you will also talk to an anaesthetist.

A doctor or nurse will insert a small needle into a vein in your hand (cannula) in order to give you drugs during the procedure. You will be asked to shave your groin and if necessary your upper chest and you will then be given a hospital gown to wear.

You must not eat or drink anything for four hours before your procedure. If you are diabetic, your nurse will discuss your tablets/insulin dose with you, because not eating may affect your blood sugar levels.

The procedure could take a couple of hours. You may wish to let your family know so that they do not worry.

During the procedure
You will be taken to the catheter lab where a nurse will stay with you and be there to reassure you throughout the procedure. There is a lot of equipment in the room, which is used to monitor your heart rhythm. You will be awake during the procedure, but to help you relax your doctor will give you a short acting sedative.
The doctor will inject a local anaesthetic into your groin to numb your leg. This may sting a little and you may feel some mild discomfort. When the local anaesthetic has taken effect, the doctor will insert a small tube (sheath) into your groin. You should not feel any pain, but if you do, please let your doctor know. Through the sheath the doctor will gently thread several flexible wires (catheter electrodes) into your heart. These special wires will record the electrical signals from inside your heart. The catheters are about the size of a small drinking straw. The doctor carefully moves the catheters into position within your heart under x-ray screening. You should not feel pain during this part of the test. Sometimes your doctor may also put a catheter in one of your veins below your collarbone.

Once the catheters are in place, your doctor will attempt to start your arrhythmia by giving your heart small electrical impulses (paced beats) to make it beat at different speeds. This allows the doctor to collect detailed information about the cause of your arrhythmia and pinpoint where the area of extra electrical activity responsible for your arrhythmia is within your heart. During this time you may feel your heart speeding up, slowing down or missing a beat. This may cause you some mild discomfort. This is a normal part of the test and in the controlled setting of an EPS is not a danger to you.

Occasionally you will also be given drugs to bring on your arrhythmia. The test will be stopped after your doctors have collected and recorded all the information they need, including how fast your heart is beating, where in your heart the arrhythmia is coming from and how easily it can be stopped.

Your arrhythmia should stop by itself. However if it continues your doctor will need to stop it by pacing your heart into a regular rhythm or giving you drugs to slow your heart rate down. Occasionally, it may be necessary to give you electric shock treatment (cardioversion). If you need this treatment your doctor will give you more sedation, as a cardioversion is not done when you are awake.

If you do have any uncomfortable symptoms during the procedure, for example, chest pain, dizziness or shortness of breath, please tell your nurse or doctor. It is important that your doctor knows how you feel when you have your arrhythmia.

After the procedure

After the procedure is completed the catheter and sheath will be removed. Firm pressure will be applied to your groin where the catheter was inserted to stop you from bleeding.

You will be moved to the recovery area where you will be monitored for a short time. On returning to the ward you will need to rest for a few hours. You may feel a little sleepy until your sedative has worn off. The nurse will record an ECG, check your blood pressure, pulse and feel your foot pulses. The nurse will also check your groin for any bleeding. It is important that you remain in bed and avoid bending your affected leg for approximately two hours after the catheter has been removed. This is to prevent any bleeding from the puncture site. After this time you will be able to get up if there are no complications. You will be able to eat and drink normally as soon as you return to the ward. The nurse will remove the small needle in your hand.

If you feel any palpitations or dizziness after the test, please let the nurse know. If the doctor has used the vein under your collarbone, you will also have a chest x-ray to make sure that you do not have a pneumothorax (pocket of air) in your lung.

Results

Your doctor will usually discuss the results and ongoing treatment plan with you and your family after the procedure.
Going home
You will normally be able to go home the following day. It is important to ask a family member or friend to collect you and drive you home. If you are being discharged on the same day as your procedure we would advise you to have someone stay with you for the night. Before you are discharged your doctor or CRM nurse will advise you regarding the medicines you will need to take, or stop and your follow-up care.

Caring for your wound
You will have a small dressing on your puncture site that can be removed the next day. It is important to keep the area clean and dry until it has healed. If you notice any swelling, redness or oozing please let your GP know.

Resuming normal activities
You can resume your normal daily activities when you leave hospital. You should not strain or lift heavy objects for a few days so the incision site can heal. Unless your job requires you to lift heavy objects, you can return to work in a day or two. You are advised not to drive a car for one week. If you hold a Group 2 PSV licence (lorries/buses) you are not allowed to drive for six weeks.

Follow-up care
Our cardiac rhythm management team will give you specific follow-up instructions when you leave hospital. Our doctors will write a detailed letter to your GP describing your hospital stay and treatment.

Cancellations
Unfortunately we do sometimes have to cancel procedures. If this happens to you, we will always try to explain the reason. We fully appreciate that this is a stressful time for you and your family and we will do our best to provide you with a new date that is convenient for you as soon as possible.

Further information and contacts
We cannot guarantee that a particular person will perform the procedure. The person will, however, have appropriate experience.

If you have any questions regarding your forthcoming procedure please call 023 8120 8436 to speak to a cardiac rhythm management clinical nurse specialist. If you have a query relating your admission date please contact the cardiac rhythm management coordinator on 023 8120 8772.

You can also email crmnurses@uhs.nhs.uk

The following websites also provide useful information:
www.bhf.org.uk
www.heartrhythmcharity.org.uk

If you need a translation of this document, an interpreter or a version in large print, Braille or on audio tape, please telephone 023 8120 4688 for help.